PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Takeshi TAKIZAWA, et al.

Docket No: Q68228

Appln. No.: 10/053,554

Group Art Unit: 2862

Confirmation No.: 3319

Examiner: Not Yet Assigned

Filed: January 24, 2002

For: WHEEL ROTATION DETECTING DEVICE

INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. §§ 1.97 and 1.98

Commissioner for Patents
Washington, D.C. 20231

Sir:

In accordance with the duty of disclosure under 37 C.F.R. § 1.56, Applicants hereby notify the U.S. Patent and Trademark Office of the documents which are listed on the attached PTO/SB/08 A & B (modified) form and/or listed herein and which the Examiner may deem material to patentability of the claims of the above-identified application.

One copy of each of the listed documents is submitted herewith.

The present Information Disclosure Statement is being filed: (1) No later than three months from the application's filing date for an application other than a continued prosecution application (CPA) under §1.53(d); (2) Before the mailing date of the first Office Action on the merits (whichever is later); or (3) Before the mailing date of the first Office Action after filing a request for continued examination (RCE) under §1.114, and therefore, no Statement under 37 C.F.R. § 1.97(e) or fee under 37 C.F.R. § 1.17(p) is required.

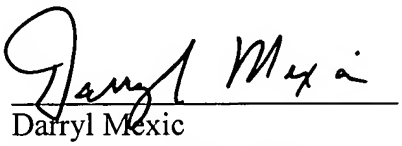
INFORMATION DISCLOSURE STATEMENT
U.S. Appln. No.: 10/053,554
ATTORNEY DOCKET NO. Q68228

In compliance with the concise explanation requirement under 37 C.F.R. § 1.98(a)(3) for foreign language documents, Applicants submit the following explanations:

The submission of the attached English language abstracts and partial English language translations along with JP Nos. 2000-329593, 2001-151090 and 8-29441 constitute concise statements of relevance of the respective references. EP 0 594 550 corresponds with US Patent No. 6,161,962, also submitted herewith. Additionally, JP Nos. 2543369 and 2539382 are accompanied by partial English language translations.

The submission of the listed documents is not intended as an admission that any such document constitutes prior art against the claims of the present application. Applicants do not waive any right to take any action that would be appropriate to antedate or otherwise remove any listed document as a competent reference against the claims of the present application.

Respectfully submitted,



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Date: October 28, 2002

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 594 550 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
12.08.1998 Bulletin 1998/33

(51) Int Cl.[6]: **G01P 3/44**

(21) Application number: **93850194.7**

(22) Date of filing: **14.10.1993**

(54) Method and device for recording operating data in a bearing

Verfahren und Vorrichtung zur Messung von Betriebszuständen in einem Lager

Procédé et dispositif pour relever les charactéristiques de l'état de fonctionnement dans un palier

(84) Designated Contracting States:
DE FR GB IT

(30) Priority: **19.10.1992 SE 9203052**
19.10.1992 SE 9203053

(43) Date of publication of application:
27.04.1994 Bulletin 1994/17

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- **PATENT ABSTRACTS OF JAPAN vol. 5, no. 196 (P-93)12 December 1981 & JP-A-56 118 640 (HITACHI LTD.)**

EP 0 594 550 B1

Printed by Jouve, 75001 PARIS (FR)

Description

Technical field

The invention relates to a method and a device in a bearing for generating current and for a recording of current operating data of said bearing.

Background art

For some time there has been an interest of recording operating data of different structural members in mechanical apparators and devices. This applies for instance to bearings which normally form key elements in many different types of constructions. By recording such operating data harmful operating conditions and peak stresses can be identified at an early stage and hopefully be avoided. Thereby it is possible to increase dramatically the length of the life of the structural member, and the costs for service and maintenance can be kept low.

The measuring means that are used for recording current operating data of the bearing can be made of a simple type and complete passive but in more advanced applications or applications in which the technical requirements are higher the measuring means are more complex and normally require some kind of power supply. The power supply can be provided either by a battery arranged in the vicinity of said means or by cable from a centrally arranged power supply means.

In a case where said structural member is hard to reach and/or the power consumption thereof is comparatively large a power supply by means of a battery is less suitable and involves large costs in maintenance and in the exchange of used batteries. In many applications the environment in which the structural member exists is such that there are large problems to provide the cabling from the power supply means, and the environment can also result in a large wear of cables and connecting means or that disturbances in the power supply voltage affect the measuring results.
Therefore, it would be indeed desirable if the power supply could be accomplished more directly in connection with the structural member, such as a bearing.

With regard to prior art bearings it is previously known to record temperatures that are critical to the bearing by means of a temperature gauge which is arranged to engage a suitable section of the bearing or the bearing housing. Such a device is disclosed in US-A-4,812,826. The device is composed of a standard bolt of standard dimensions in which is arranged a temperature sensing element and an antenna, the latter being projected from said bolt when a predetermined temperature is recorded by said element. The device according to US-A-4,812,826 will provide an indication that said bearing at some moment has obtained said predetermined temperature. It is not possible to provide a continuous indication of the present temperature.

In railway applications it is previously known for a long time to sense contactless the temperature of the bearing boxes of the train and the railway-carriages. In such applications IR detectors are mounted on the ground very close to the railway to sense the temperature of the bearing boxes when these pass the detectors. Information of excess temperatures in specific bearing boxes are passed on to different types of indicating means arranged along the railway. The engine-driver, or other operators, may then read the information and act correspondingly, for instance by exchanging a bearing or disconnecting a carriage having a bearing that is overheated or damaged. This method allows only an indirect sensing of the temperature of the bearing and many factors influence the sensing of the temperature and the transmission of the information regarding the temperature to any appropriate personnel.

According to prior art technique it is also known to monitor other operating data of bearings. US-A-4,069,435 for instance discloses a device in a bearing for sensing the relative rotational speed of different elements of the bearing. Said device comprises a coil which is mounted in the sealing means of the bearing axially displaced from the balls of the bearing at the same radius as the balls from the center of the bearing. A permanent magnet is received in said coil, and said magnet generates a magnetic field extending over the balls of the bearing. When the bearing rotates the balls of the bearing pass through said magnetic field and the field is disturbed. The disturbance in turn generates a current in said coil and by recording the variation of said current a signal is obtained which is proportional to the rotational speed of said bearing. The signal from said coil is then passed on to some kind of recording unit through a wire connection. Said patent does not disclose nor point in the direction of utilizing the device for generating electric current to supply measuring means or similar devices.

A way of providing power to a self-powered monitor unit is disclosed in US-A-4,237,454. Said monitor including a tuned mechanical resonator and a radio transmitter is mounted on rotating equipment to be monitored, for instance a ball bearing. The resonator includes a piezo-ceramic element which generates a high voltage, low current electrical power to drive different elements of said monitor. The monitor according to US-A-4,237,454 is mounted on stationary housing at a position to sense structure-borne vibrations emanating from the bearing.

Summary of the invention

An object of the present invention is to overcome as far as possible drawbacks and disadvantages indicated above of prior art systems for indicating and recording operating data of structural members. The method according to the invention accomplishes a local processing of measuring signals that are obtained from sensors mounted within the bearing or in the vicinity

thereof, and also that any process signals are transmitted from the processing spot to recording means arranged remotely of said spot.

Another object is to avoid drawbacks and disadvantages of prior art systems for generating electric current to power measuring means in structural member.

The above-mentioned objects are achieved according to the invention by transforming locally within sealing means of the bearing measuring signals to measured values and by transmitting in an intermittent way said measured values to a remote recording means. The measured signals are transformed in a central unit and transmitted by a transmitting means operatively connected to said central unit. In one aspect of the invention said central unit and said transmitting means are operatively connected to an electric generator which is integrated in the bearing within sealing means of the bearing.

Further objects and features of the present invention are apparent from the following description and drawings together with the dependent claims.

Brief description of the drawings

The invention will be described in more detail by means of embodiments with reference to the accompanying drawings, in which

FIG 1 is a block diagram showing a device according to the invention,
FIG 2 is a schematic cross sectional view of the device according to FIG 1 mounted in a bearing,
FIG 3 schematically shows one embodiment of a generator included in the device according to the invention,
FIG 4 schematically shows an alternative embodiment of said generator,
FIG 5 schematically shows a further embodiment of a generator,
FIG 6 is a block diagram showing an electric circuit connected to the generators of FIGs 3-5,
FIG 7 is a side view showing schematically one embodiment of a generator according to FIG 5, and
FIG 8 is a block diagram showing a central unit included in the device according to the invention.

Detailed description of the invention

FIG 1 shows a device according to the invention to be mounted in a bearing 10 (see FIG 2), the device including a sensor 11 for sensing for instance temperature. Said sensor 11 is operatively connected to a central unit 12. Said central unit includes a plurality of memory units (not shown) together with calculating means for transforming measured signals received from said sensor 11. Said calculating means comprises preferably buffert means and an analog-digital transformer. The electric energy required to supply said central unit 12 and normally also said sensor 11 is generated in a generator 13 which is operatively connected to said central unit 12 through a rectifier circuit 14 and a voltage regulator 15. Measured signals processed or transformed in said central unit are fed according to the invention to a superior processing or indicating means, said superior means can be arranged anywhere in the vehicle in which said bearing 10 is mounted or in a driving vehicle connected to said vehicle. According to a preferred embodiment of the invention said transformed measured signals are transferred by a wireless connection by means of a transmitter 16 operatively connected to said central unit 12, said transmitter 16 in turn being operatively connected to an antenna 17. Through said antenna 17 said device 20 has a wireless connection to a remote recording means 18 thus forming the superior processing means.

According to the invention it is also possible to control the function of the central unit and thereby to vary the method of measuring and recording in any desired way. To accomplish this the device according to the invention is provided with a receiver 19 operatively connected to said antenna 17 as well as to said central unit 12.

As the device according to the invention preferably should be used in bearings and as said generator 13 is mounted within said bearing in such a way that electric current is generated in said generator when said bearing rotates the power supply of the central unit 12 should be ensured also during an idle condition, that is when the bearing does not rotate. The power supply is ensured also during such conditions by means of a battery unit 21. Preferably said battery unit 21 comprises one or a plurality of storage cells or accumulator batteries which are recharged by said generator through said rectifier 14 and said voltage regulator 15. In a preferred embodiment the processing capacity of said central unit 12 is used also to control said generator and/or said voltage regulator to accomplish charging and maintenance charging of said storage cell of the battery unit 21 in the best possible way.

According to the invention also other operating data than the temperature can be recorded. Other sensors that can be mounted within the bearing or in the vicinity thereof are sensors for vibrations, sound, stress forces, pressure and torque. Different types of sensors can be provided but as a result of the measured signals from said sensors being processed and transformed in said central unit 12 all sensors can be looked on by said recording means 18 as sensors of a uniform type. FIG 1 also shows a possibility to measure and record by means of said generator 13 the rotational speed of the bearing 10 or a shaft connected thereto. According to the invention the rotational speed is measured by feeding current pulses from said generator 13 to said central unit 12 through some type of buffert or filter 22. By means of said central unit 12 it is then possible to calculate the average speed, speed changes of the bear-

ing, the absolute speed, and other data related thereto.

FIG 2 shows the mounting of the device 20 in a bearing 10. Said device 20 as well as said generator 13 are enclosed by sealing means 38 provided in the bearing. Said sealing means 38 can be of a conventional type or formed specifically to receive in an appropriate way the device 20 and the generator 13.

FIGs 3-5 show schematically alternative embodiments of said generator 13. The embodiment of the generator 13 shown in FIG 3 comprises an iron core 23 and a winding 24 surrounding said core. Radially outside said iron core 23 a ring is arranged on which mutually spaced permanent magnets 25 are attached. Radially between said iron core 23 and said ring with permanent magnets 25 there is arranged a movable disc or ring having metal discs or metal blades. Said disc or ring rotates together with said bearing at the rotational speed of the bearing.

An alternative embodiment of said generator 13 is shown in FIG 4. The generator 13 is provided with a separate excitation by means of a second iron core 26 with associated windings 27. Both iron cores 23 and 26 are fixedly mounted peripherally in the bearing. Between said both iron cores 23 and 26 a ring extends on which is mounted mutually spaced metal blades or metal plates.

The generator according to FIG 5 comprises an iron core 23 on which a winding 24 is provided. Said iron core 23 and said winding 24 are mounted in a peripheral section of a non-rotating part of the bearing. Outside thereof and on a rotating part of the bearing a number of permanent magnets 25 are arranged. Said permanent magnets 25 are arranged on a circle line and preferably cover the complete circumference. However, it is possible also to provide said permanent magnets 25 on a sector only.

The different types of generators disclosed above all generate a pulsating alternating current which is rectified in said rectifier 14, compare FIG 1. By phase shifting said windings 27 it is possible to obtain a large number of pulses at each revolution without the necessity of arranging a large number of magnet 25.

To ensure best possible charge conditions in said battery unit 15 a control circuit 29 is provided therein. The rectifier 14 shown in FIG 6 is formed as a rectifier bridge. The current from said rectifier bridge is fed through a transistor 30 and a resistor 31 to a accumulator 32, preferrably being a type of nickel-kadmium battery. Current operating conditions of the accumulator 13 such as the temperature, charging current and surface voltage are continuously monitored by the control circuit 29. Said control circuit 29 controls through said transistor 30 the charging current in dependence of the operating data of the accumulator.

A basic practical embodiment of the generator 13 is shown in FIG 7. The iron core 23 is fixedly mounted in a non-moving section of the bearing and receives the winding 27. A plurality of permanent magnet 25 are mutually spaced on a ring connected to a rotating section of the bearing. The ring is arranged so that said permanent magnets 25 pass the poles of the iron core 23 at some air-gap.

In applications where the bearing rotates essentially continuously the accumulator 32 may be omitted or exchanged to a capacitor to ensure some supply current even during idle conditions.

Preferrably the communication between the transmitter 16 and the recording unit 18 and through the receiver 19 and the recording unit 18 is made by radio through the antenna 17 but also other wireless transmission methods can be used. In some conditions it may for instance be appropriate to use IR-light. In some specific favourable conditions it may also be possible to carry out the communication by wire, and in such cases the antenna 17 is omitted.

The central unit 12 comprises according to FIG 8 a first memory means 33 storing limit values and similar data indicating pre-determined conditions for the bearing. Examples of such data are the maximum bearing temperature, the runtime between points of maintenance, and maximum allowed forces in the bearing. Preferably said memory means 33 includes also a code or an address that is unique to the bearing and provides the bearing with an identity. Such identity data can be used to investigate by means of specific service terminals the status of elected bearings in an apparatus or a vehicle. Said address data can also be included in the signals transmitted from the transmitter 16. In such a way a recording means 18 may serve a plurality of bearings. It is also possible to utilize the address data to identify the complete vehicle.

Said memory means 33 is operatively connected to a comparator 34 in which data stored in said memory means 33 are compared to measured data. Warning signals and corresponding data are interchanged through a connection between comparator 34 and said transmitter 16 if measured operating data deviate incorrectly from stored data.

Said central unit 12 also comprises a second memory means 35 for storing measured values generated as measured signals by the sensors. Measured data are stored partly to be transmitted in an intermittent way or as a response on requests from the recording unit 18 or another corresponding unit and partly to be compared to values stored in said first memory means.

Signals provided by the filter or buffert 22 relating to the rotation of the bearing are fed through a connection to a timing means 36 included in said central unit 12, said timing means being operatively connected to a calculating means 37 also included in said central unit 12. In said calculating means 37 rotating time and similar data concerning the bearing are determined and then the rotational speed of the bearing can be calculated. Said calculating means 37 may also continuously accumulate operating periods of the bearing so as to keep information about the total runtime of the bearing

available at all times.

The means included in said central unit 12 can be implemented in hardware as separate or partly combined integrated circuits. When the dimensions are small the integrated circuits are exchanged by chips directly mounted on circuit boards or silicone plates. It is possible also to implement some units as software in a general computer circuit.

The device described above can be modified in many ways within the scope of the claimed invention.

Claims

1. A method for recording current operational data of a bearing (10) such as the rotational speed or the temperature of the bearing, said-operational data being obtained locally at the bearing as at least one electric signal, **characterized** in that said electric signal is processed locally within a sealed space (38) in the bearing to produce at least one measured value, and that said measured value is transmitted intermittently by wireless transmission from the bearing to at least one recording means remote from the bearing and is recorded.

2. A method according to claim 1, **characterized** in that at least one limit value is stored locally at the bearing (10), said limit value forming the limit for a variation of said measured value.

3. A method according to claim 1 or 2, **characterized** in that said measured value is stored continuously locally at said bearing (10), and that said measured value is transmitted to said recording means responsive to an external command from the recording means.

4. Method according to any of claims 1-3, **characterized** in that an electric signal responsive to the operating temperature of said bearing is obtained from a temperature sensitive section of the bearing.

5. A method according to any of claims 3-4, **characterized** in that rotation of said bearing is sensed, that time periods during which said bearing rotates are recorded, and that a total value formed by the sum of said periods is stored continuously.

6. A device for recording operational current data of a bearing (10), such as rotational speed and temperature of the bearing, comprising sealing means (38) mounted in the bearing (10) to enclose a space therein, and at least one sensor (11) for generating locally an electric signal representing said operational data, **characterized** by a central unit (12) disposed within said space and operatively connected to said sensor (11) for transforming the electric signal to measured values, and transmitter means (16) disposed within said space and operatively connected to said central unit (12) for wireless transmission of said measured values to at least one recording means remote from said space.

7. A device according to claim 6, **characterized** in that said central unit (12) comprises first memory means (33) for storing limit values that said measured value may vary within, and comparator means (34) for comparing said measured value to said limit values, and that said comparator means is operatively connected to said transmitter means (16) for transmitting a signal to said recording means if said measured value falls outside said limit values.

8. A device according to claim 6 and 7, **characterized** in that said central unit (12) comprises second memory means (35) for storing said measured values, and that receiver means (19) is operatively connected to said central unit (12) and to said recording means (18) for receiving control signals from the recording means (18), said control signals instructing said central unit (12) to transmit measured values to said recording means (18).

9. A device according to any of claims 6-8, **characterized** in that at least one temperature sensor (11) is mounted in a temperature sensitive section of the bearing or engaging such a section, and that said temperature sensor (11) is operatively connected to said central unit (12).

10. A device according to any of claims 6-8, **characterized** by a generator (13) having a rotor engaging a rotating section of said bearing, and a stator engaging a non-rotating section of said bearing, or vice versa, for generating current pulses when said bearing rotates, said central unit (12) comprising time measuring means for measuring the time period between current pulses, and calculating means for calculating the rotational speed of said bearing based on said measured time period between said current pulses.

Patentansprüche

1. Verfahren zum Aufzeichnen laufender Betriebsdaten eines Lagers (10), beispielsweise der Drehzahl oder der Temperatur des Lagers, welche Betriebsdaten vor Ort an dem Lager in Form zumindest eines elektrischen Signals erhalten werden, **dadurch gekennzeichnet,** daß das elektrische Signal vor

Ort in einem abgedichteten Raum (38) in dem Lager verarbeitet wird, um mindestens einen Meßwert zu erzeugen, und daß der Meßwert intermittierend drahtlos von dem Lager zu mindestens einer Aufzeichnungseinrichtung entfernt von dem Lager übertragen und aufgezeichnet wird.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet,** daß mindestens ein Grenzwert vor Ort an dem Lager (10) gespeichert ist, wobei der Grenzwert die Grenze für eine Änderung des Meßwerts darstellt.

3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet,** daß der Meßwert kontinuierlich vor Ort in dem Lager (10) gespeichert wird, und daß der Meßwert ansprechend auf einen externen Befehl von der Aufzeichnungseinrichtung zu der Aufzeichnungseinrichtung übertragen wird.

4. Verfahren nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet,** daß ein elektrisches Signal in Abhängigkeit der Betriebstemperatur des Lagers von einem temperaturempfindlichen Teil des Lagers gewonnen wird.

5. Verfahren nach einem der Ansprüche 3 bis 4, **dadurch gekennzeichnet,** daß die Drehung des Lagers erfaßt wird, daß Zeitspannen, während denen das Lager sich dreht, aufgezeichnet werden, und daß ein Gesamtwert, gebildet durch die Summen der Zeitspannen, kontinuierlich gespeichert wird.

6. Vorrichtung zum Aufzeichnen von laufenden Betriebsdaten eines Lagers (10), zum Beispiel der Drehzahl und der Temperatur des Lagers, umfassend eine Dichtungseinrichtung (38), die in dem Lager (10) angebracht ist, um dort einen Raum einzuschließen; und mindestens einen Sensor (11) zum lokalen Erzeugen eines die Betriebsdaten repräsentierenden elektrischen Signals,
gekennzeichnet durch eine Zentraleinheit (12), die in dem Raum angeordnet und betrieblich mit dem Sensor (11) gekoppelt ist, um das elektrische Signal in Meßwerte umzuformen, und eine Sendeeinrichtung (16), die in dem Raum angeordnet und betrieblich mit der Zentraleinheit (12) verbunden ist zwecks drahtloser Übertragung der Meßwerte zu mindestens einer von dem Raum entfernten Aufzeichnungseinrichtung,

7. Vorrichtung nach Anspruch 6, **dadurch gekennzeichnet,** daß die Zentraleinheit (12) eine erste Speichereinrichtung (33) zum Speichern von Grenzwerten aufweist, innerhalb derer der Meßwert schwanken kann, ferner eine Vergleichereinrichtung (34) zum Vergleichen des Meßwerts mit den Grenzwerten, und daß die Vergleichereinrichtung betrieblich mit der Sendeeinrichtung (16) gekoppelt ist, um an die Aufzeichnungseinrichtung ein Signal zu senden, wenn der Meßwert außerhalb der Grenzwerte liegt.

8. Vorrichtung nach Anspruch 6 oder 7, **dadurch gekennzeichnet,** daß die Zentraleinheit (12) eine zweite Speichereinrichtung (35) aufweist, um die Meßwerte zu speichern, und daß die Empfangseinrichtung (19) betrieblich mit der Zentraleinheit (12) und der Aufzeichnungseinrichtung (18) gekoppelt ist, um von der Aufzeichnungseinrichtung (18) Steuersignale zu empfangen, welche die Zentraleinheit (12) anweisen, Meßwerte zu der Aufzeichnungseinrichtung (18) zu senden.

9. Vorrichtung nach einem der Ansprüche 6 bis 8, **dadurch gekennzeichnet,** daß mindestens ein Temperatursensor (11) in einem temperaturempfindlichen Bereich des Lagers untergebracht ist oder mit einem solchen Bereich zusammenwirkt, und daß der Temperatursensor (11) betrieblich mit der Zentraleinheit (12) gekoppelt ist.

10. Vorrichtung nach einem der Ansprüche 6 bis 8, **gekennzeichnet durch** einen Generator (13) mit einem Rotor, der mit einem Drehteil des Lagers in Eingriff steht, und einem Stator, der mit einem nichtdrehenden Teil des Lagers in Eingriff steht, oder umgekehrt, um Stromimpulse immer dann zu erzeugen, wenn sich das Lager dreht, wobei die Zentraleinheit (12) eine Zeitmeßeinrichtung zum Messen der Zeitspanne zwischen Stromimpulsen aufweist, ferner eine Berechnungseinrichtung zum Berechnen der Drehzahl des Lagers basierend auf der gemessenen Zeitspanne zwischen den Stromimpulsen.

Revendications

1. Procédé d'enregistrement des données fonctionnelles instantanées d'un palier (10), telles que la vitesse de rotation ou la température du palier, lesdites données opérationnelles étant obtenues localement au niveau du palier sous forme d'au moins un signal électrique, caractérisé en ce que ledit signal électrique est traité localement à l'intérieur d'un espace étanche (38) situé dans le palier afin de produire au moins une valeur mesurée, et en ce que ladite valeur mesurée est transmise de façon intermittente, par une transmission sans fil, depuis le palier, à au moins un moyen d'enregistrement distant du palier et est enregistrée.

2. Procédé selon la revendication 1, caractérisé en ce qu'au moins une valeur limite est stockée localement au niveau du palier (10), ladite valeur limite

constituant la limite de variation de ladite valeur mesurée.

3. Procédé selon la revendication 1 ou 2, caractérisé en ce que ladite valeur mesurée est stockée de façon continue localement au niveau dudit palier (10), et en ce que ladite valeur mesurée est transmise auxdits moyen d'enregistrement en réponse à une instruction externe issue des moyens d'enregistrement.

4. Procédé selon l'une quelconque des revendications 1-3, caractérisé en ce qu'un signal électrique, constituant une réponse à la température de fonctionnement dudit palier, est obtenu depuis une section sensible à la température du palier.

5. Procédé selon l'une quelconque des revendications 3-4, caractérisé en ce que la rotation dudit palier est appréhendée, en ce que les périodes de temps pendant lesquelles ledit palier tourne sont enregistrées, et en ce qu'une valeur totale, formée par la somme desdites périodes, est mémorisée de façon continue.

6. Dispositif d'enregistrement des données fonctionnelles instantanées d'un palier (10), telles que la vitesse de rotation et la température du palier, comprenant des moyens d'étanchéité (38) montés dans le palier (10), afin d'y enfermer un espace, et au moins un capteur (11), destiné à générer localement un signal électrique représentatif desdites données opérationnelles, caractérisé en ce qu'une unité centrale (12) est disposée à l'intérieur dudit espace et est reliée fonctionnellement audit capteur (11) pour transformer le signal électrique en des valeurs mesurées, et par des moyens transmetteurs (16) disposés à l'intérieur dudit espace et reliés fonctionnellement à ladite unité centrale (12) pour effectuer une transmission sans fil desdites valeurs mesurées à au moins un moyen d'enregistrement distant dudit espace.

7. Dispositif selon la revendication 6, caractérisé en ce que ladite unité centrale (12) comprend des premiers moyens de mémoire (33) conçus pour stocker des valeurs limites entre lesquelles ladite valeur mesurée peut fluctuer, et des moyens comparateurs (34) destinés à comparer ladite valeur mesurée auxdites valeurs limites, et en ce que lesdits moyens comparateurs sont reliés fonctionnellement audit moyen transmetteur (16), pour transmettre un signal auxdits moyens d'enregistrement si ladite valeur mesurée tombe hors desdites valeurs limites.

8. Dispositif selon les revendications 6 et 7, caractérisé en ce que ladite unité centrale (12) comprend des deuxièmes moyens de mémoire (35) destinés à mémoriser lesdites valeurs mesurées, et en ce que des moyens récepteurs (19) sont reliés fonctionnellement à ladite unité centrale (12) et auxdits moyens d'enregistrement (18), pour recevoir des signaux de commande venant des moyens d'enregistrement (18), lesdits signaux de commande donnant instruction à ladite unité centrale (12) de transmettre des valeurs mesurées auxdits moyens d'enregistrement (18).

9. Dispositif selon l'une quelconque des revendications 6-8, caractérisé en ce qu'au moins un capteur de température (11) est monté dans une section sensible à la température du palier ou en contact avec une telle section, et en ce que ledit capteur de température est relié fonctionnellement à ladite unité centrale (12).

10. Dispositif selon l'une quelconque des revendications 6-8, caractérisé par un générateur (13), ayant un rotor venant en contact avec une section tournante dudit palier et un stator contact avec une section non-tournante dudit palier, ou vice-versa, afin de générer des impulsions électriques lorsque ledit palier tourne, ladite unité centrale (12) comprenant des moyens de mesure de temps conçus pour mesurer la période de temps s'écoulant entre des impulsions électriques, et des moyens de calcul destinés à calculer la vitesse de rotation dudit palier en se basant sur ladite période de temps mesurée entre lesdites impulsions électriques.

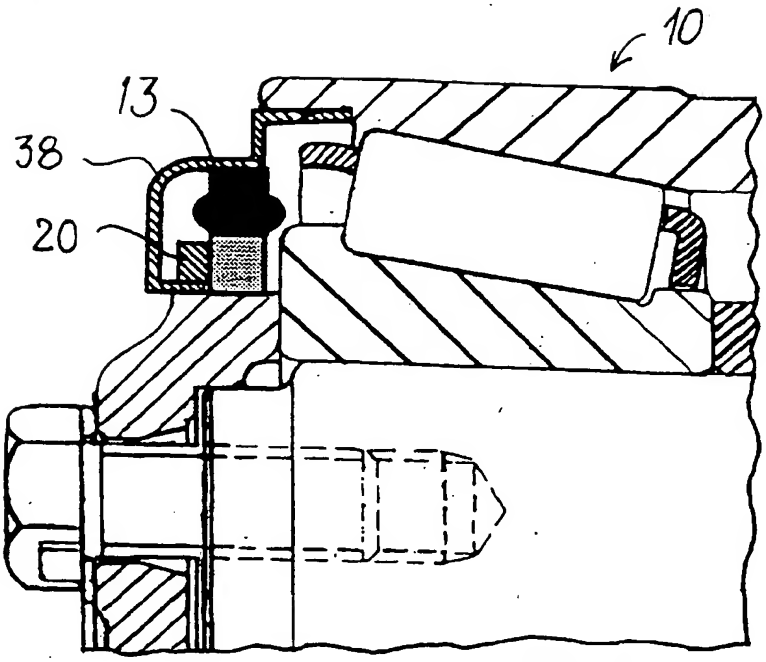

FIG 2

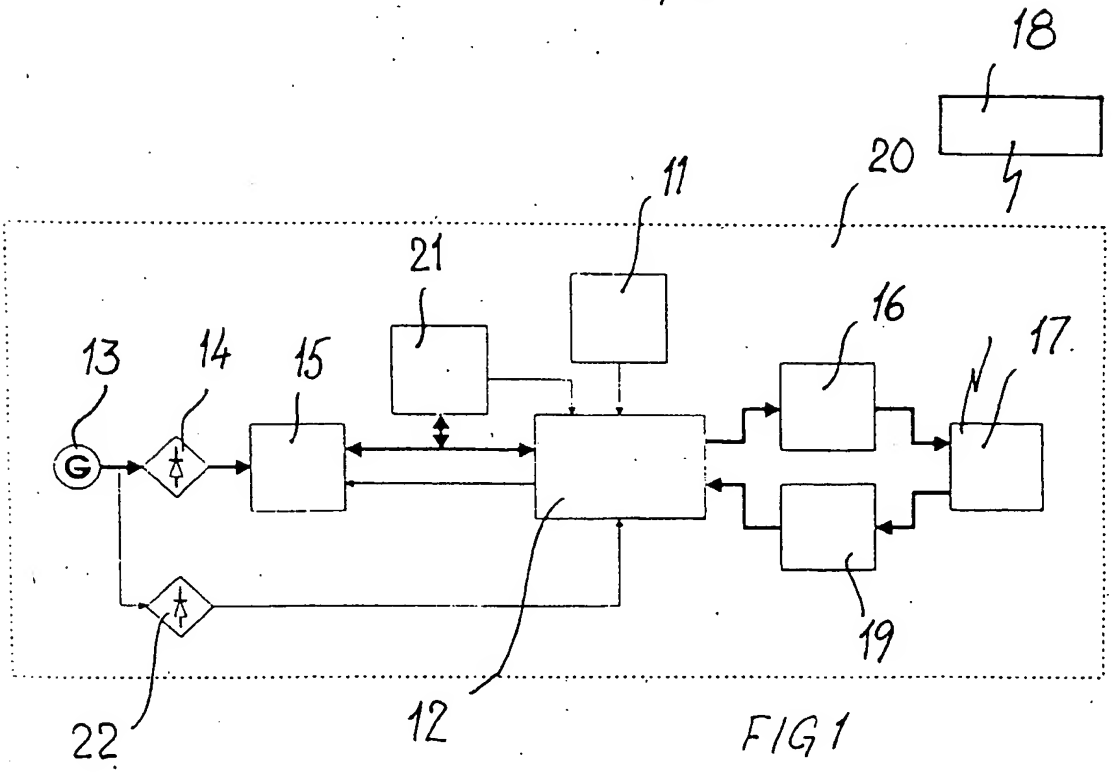

FIG 1

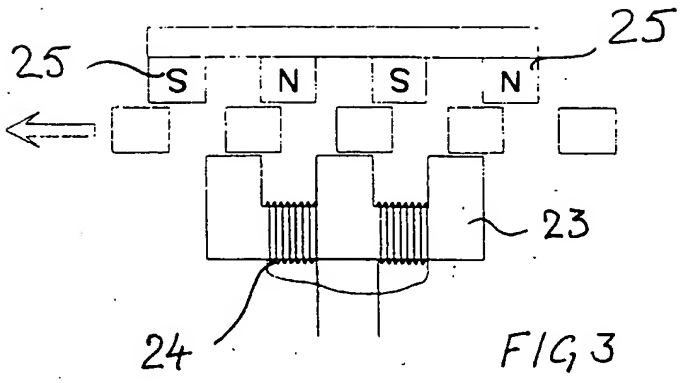

FIG 3

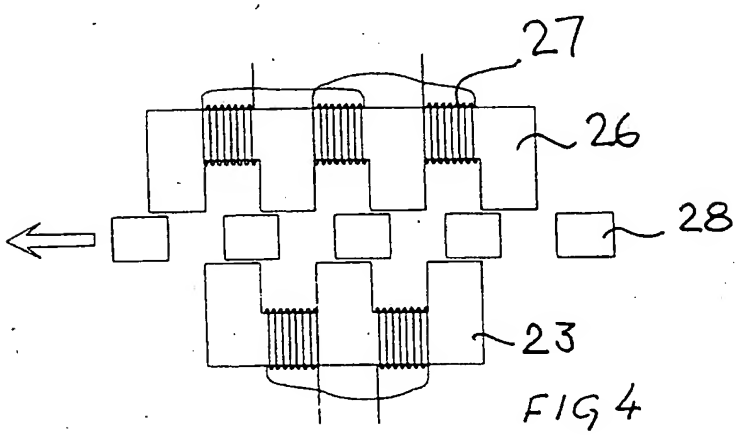

FIG 4

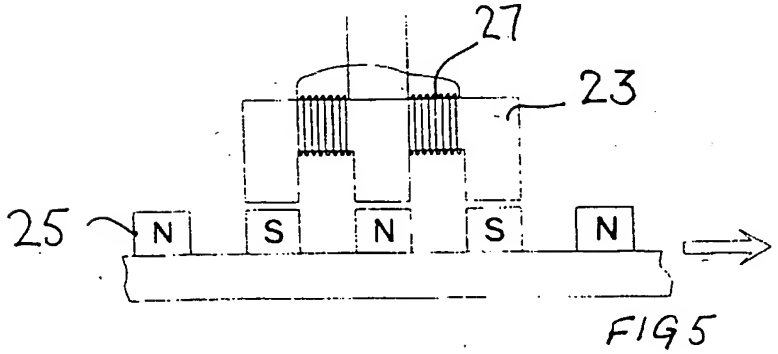

FIG 5

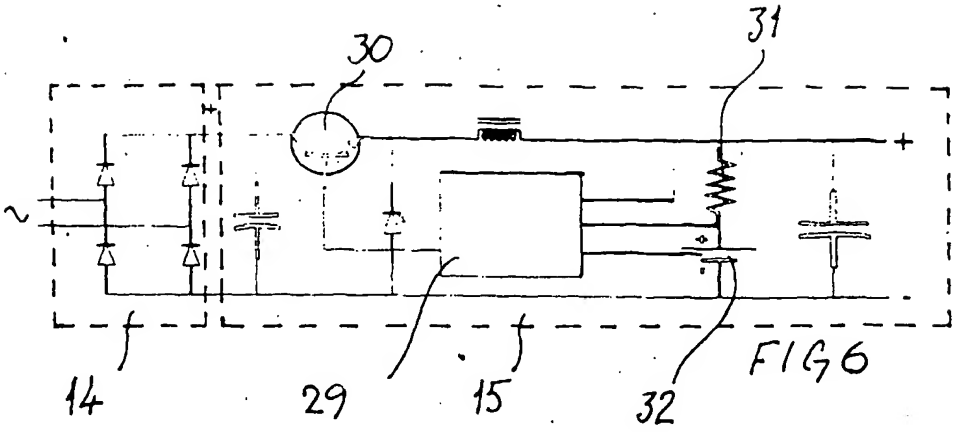

FIG6

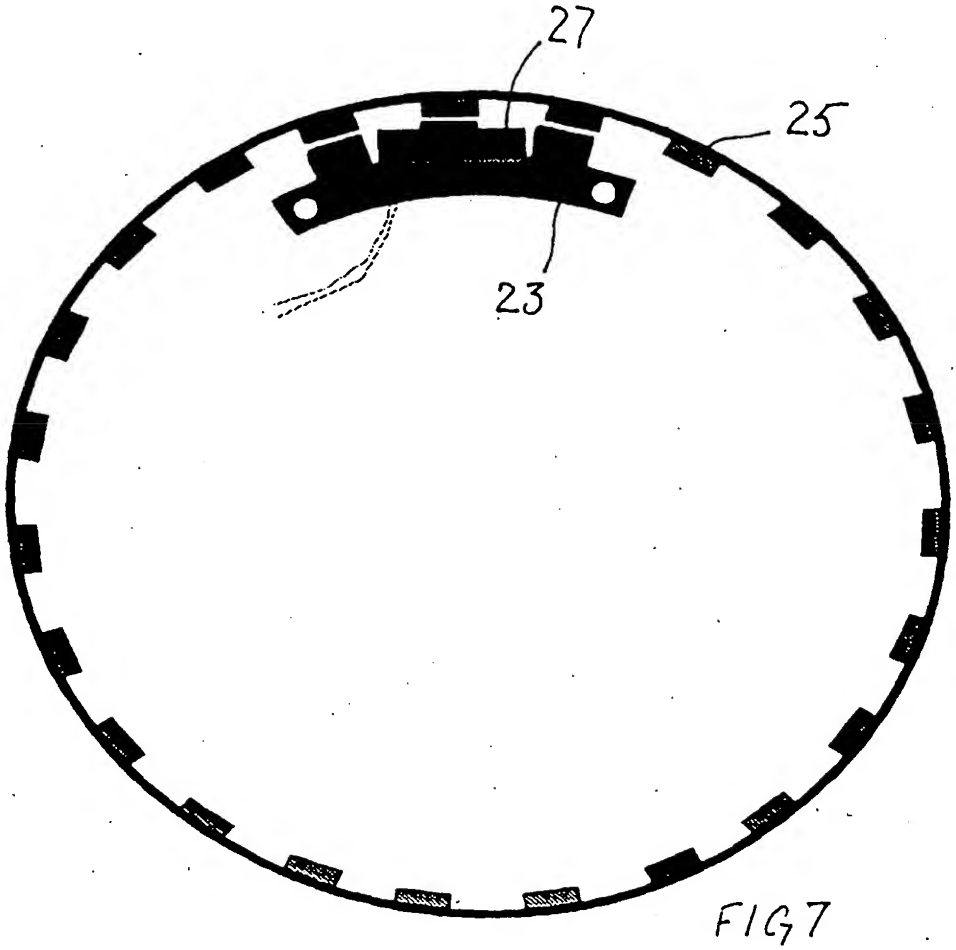

FIG7

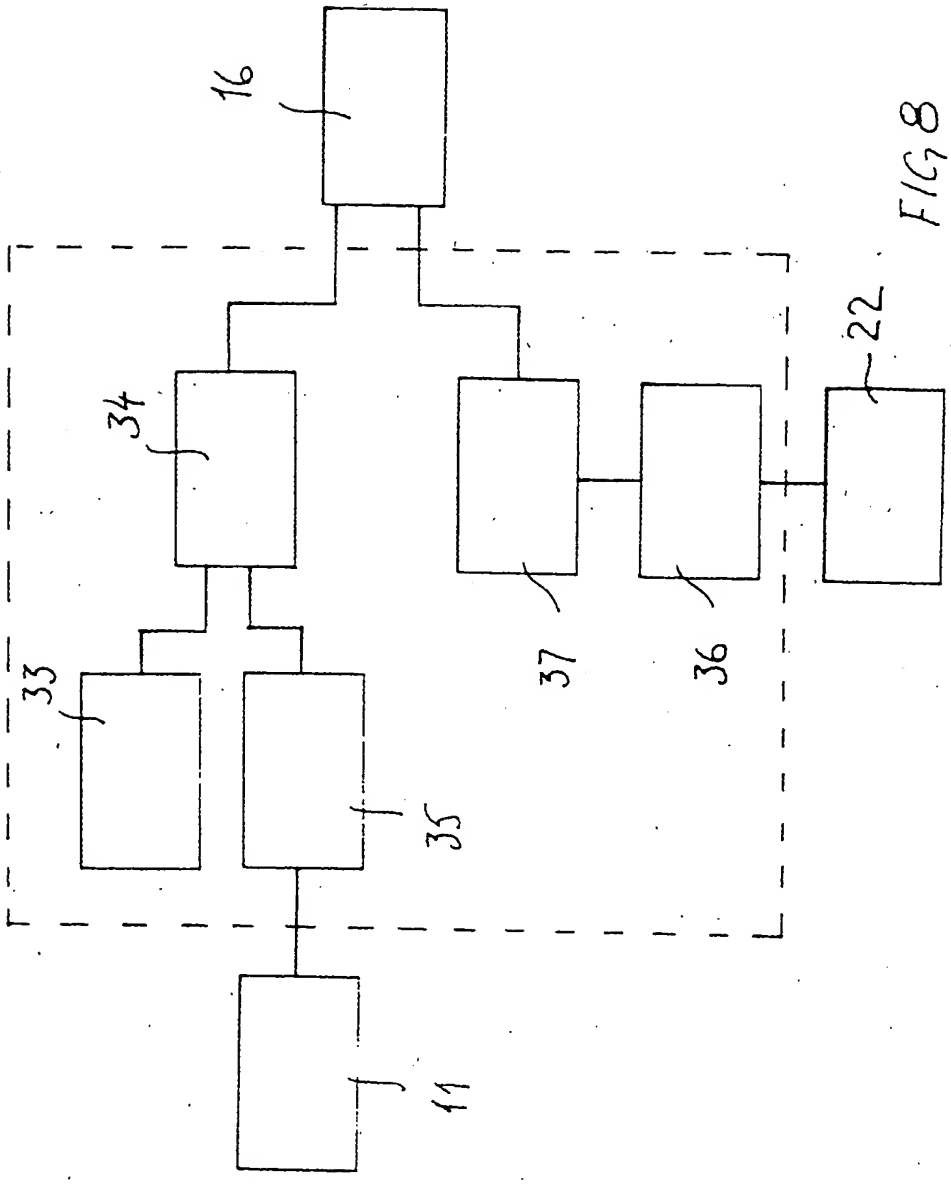

FIG 8

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-329593
(43)Date of publication of application : 30.11.2000

(51)Int.Cl. G01D 21/00

(21)Application number : 11-141231
(22)Date of filing : 21.05.1999

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(72)Inventor : OKADA KOICHI
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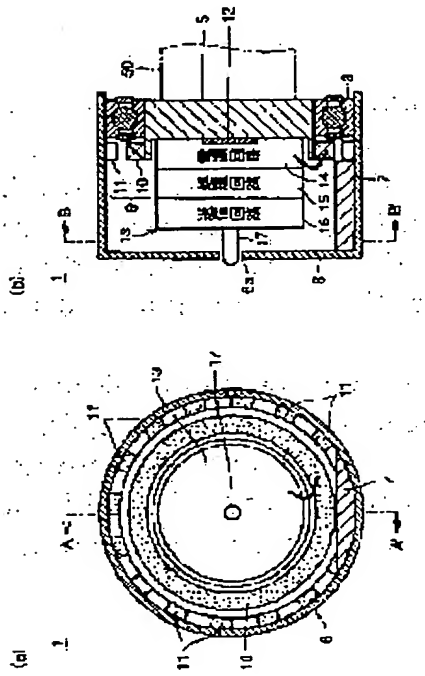
(54) ROTOR STATE-DETECTING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a reliable and compact rotor state-detecting device.
SOLUTION: The detector 1 is provided with an inner lid 5 that is rotated together with a rotary shaft 50, an outer lid 6 whose rotation is prevented by a weight 7 and a bearing 8, a generator 9 containing a coil 10 being provided at the inner lid 5 and a magnet 11 being provided at the outer lid 6, and a circuit unit 13 and a light-emitting device 17 for transmitting the detection result of a vibration sensor 12. The need for wiring and a slit ring is eliminated, thus improving reliability and miniaturizing the device.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

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[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the anti-lock brake equipment in an automobile.

[0002]

[Description of the Prior Art] The tire lock at the time of a low friction way or a panic brake is detected in the latest automobile, and many anti-lock brake equipments (ABS) which plan steering stability by loosening a brake and securing a tire grip are adopted as it. Although the rotation sensor was attached in axle bearing and the rotational frequency is detected with this equipment, the electric power supply to the sensor and the output signal of a sensor are communicating with the body section with the electric wire.

[0003]

[Problem(s) to be Solved by the Invention] Between axle bearing and the body, it will expose outside a vehicle and this electric wire tends to cause trouble, such as an open circuit, by the freeze of the snow in stone splashes or a tire house. Moreover, in the case of a steering wheel, it is necessary to give a twist beforehand to an electric wire or, and it needs a great man day for fixation of an electric wire. The covering is also required for the above-mentioned electric wire, and it serves as hindrance of lightweight-izing of an automobile, and since there are many man days of fixation of an electric wire, it is an increase of cost.

[0004] The purpose of this invention is offering the anti-lock brake equipment which there is no fear of an open circuit out of a vehicle, and can aim at lightweight-izing of an automobile, and a cost fall.

[0005]

[Means for Solving the Problem] In the anti-lock brake equipment which this invention detects the rotational speed of a wheel and controls brake damping force by the detecting signal The pulser ring with which the rotation member of a wheel was equipped, and the sensor with which stood face to face against this pulser ring, and wheel supporter material was equipped. It has the control circuit which is installed in the body and controls the

above-mentioned damping force, and the wireless means of communication which the transmitting section and a receive section are respectively installed in the above-mentioned wheel supporter material and the body, and send and receive the signal of the above-mentioned sensor by wireless. Thus, from the transmitting section of wheel supporter material, in order to transmit to the receive section by the side of the body by wireless, the electric wire for sensor signal transduction does not expose the signal of a rotation sensor outside a vehicle between a wheel supporter and the body. Therefore, trouble of an open circuit is not caused by the freeze of the snow in stone splashes or a tire house etc. Moreover, since the electric wire for the sensor signals between a wheel supporter and the body can be excluded and the complicated wiring fixed work also becomes unnecessary, lightweight-izing of an automobile and a cost fall can be aimed at.

[0006] The signal which transmits space should just be used for the above-mentioned wireless means of communication for what performs transmission by light, such as transmission not only by an electric wave but magnetic coupling, and infrared radiation, or transmission by the ultrasonic wave. In magnetic coupling **** transmission, the signal transmission of the above-mentioned wireless means of communication shall be carried out by the magnetic coupling between the transmitting coil prepared in the transmitting section, and the receiver coil prepared in the receive section. A transmitting coil is excited on the frequency of arbitration and makes a receiver coil generate voltage in electromagnetic induction. In transmission by the ultrasonic wave, the signal transmission of the above-mentioned wireless means of communication shall be carried out ultrasonically. In this case, it is made to oscillate by ultrasonic vibrators, such as a piezoelectric device, and the above-mentioned transmitting section modulates and transmits the ultrasonic wave by the signal of a sensor. 20kHz or more exceeding a audio range is used for frequency. In transmission by light, the signal transmission of the above-mentioned wireless means of communication shall be carried out with light. In this case, the above-mentioned transmitting section turns light emitting devices, such as a laser diode and Light Emitting Diode, to the interior of the tire house of the body, arranges them, and turns and arranges photo detectors, such as a photodiode and a photo transistor, as the above-mentioned receive section into the body at a transmitting section side. In transmission by the electric wave, the signal transmission of the above-mentioned wireless means of communication shall be carried out by the feeble electric wave. Let this feeble electric wave be the electric wave (500micro below of field strength [For example, a 322Mz board 3m distance] V) which does not receive regulation of Wireless Telegraph Law.

[0007] The signal which is transmitted from the transmitting section in the case of the wireless means of communication of each above-mentioned composition (i.e., the case of magnetic coupling, an ultrasonic wave, light, and the wireless means of communication transmitted by any of a feeble electric wave) may be a simple on-off signal, and may modulate a subcarrier by the signal of a sensor. When modulating a subcarrier, the above-mentioned receive section makes it receive [align it and] and restore to the signal transmitted in the

above-mentioned transmitting section. The modulation of a subcarrier may turn a subcarrier on and off, and may carry out frequency modulation of the subcarrier. Thus, when modulating a subcarrier and carrying out the alignment recovery of this, the influence of an external noise can be mitigated.

[0008] In this invention, you may establish a wireless electric supply means to give power required for the transmitting section and the sensor of the above-mentioned wireless means of communication by wireless from a body side. Thus, by establishing a wireless electric supply means, the electric wire for electric supply is not exposed outside a vehicle between a wheel supporter and the body, and the problem of an open circuit of this electric wire for electric supply is also solved. Moreover, unlike the case where a generator is formed, electric power can be supplied also at the time of a body halt, and a zero prompt speed signal can be acquired. A wireless electric supply means is also depended on magnetic coupling, and also, as for transfer of the power by wireless, it can change and transmit power to light, an ultrasonic wave, an electric wave, etc. By the wireless electric supply means, whether it considers as which transfer method by magnetic coupling, light, the ultrasonic wave, the electric wave, etc. is considering as the same method as the transfer method adopted with the wireless means of communication of a sensor signal, and it can attain part communalization of a wireless electric supply means and a wireless means of communication, and communalization of handling.

[0009] this invention -- setting -- the above-mentioned rotation -- the generator generated by rotation of a member is formed and you may make it give the power generation output of the generator to the above-mentioned transmitting section and a sensor Thus, a sensor signal can be transmitted by forming the generator using the turning effort of a wheel, without carrying out an electric power supply separately. Therefore, the wiring for electric power supplies can be excluded.

[0010] moreover, this invention -- setting -- the above-mentioned sensor -- the above-mentioned rotation -- it consists of a generator generated by rotation of a member, this generator is made into the thing of the number which can generate the pulse number which needs the number of magnetic poles for detection of a rotational frequency, and the above-mentioned transmitting section is good also as what transmits power generation frequency as a rotational-speed signal Thus, by using a sensor as a generator, without preparing a rotation sensor separately, the frequency of a generator can be used as a rotation signal as it is, and simplification of composition can be attained.

[0011]

[Embodiments of the Invention] The operation gestalt of this invention is explained based on a drawing. the hub whose wheel 1 is a turning wheel of the axle bearing 2 in drawing 1 -- the wheel supporter material 4 which is attached in a ring 3 and consists of a fixed ring of the axle bearing 2 -- from the body 5 -- caudad -- a protrusion -- it is supported by the suspension (not shown) the bottom In the example of illustration, a wheel 1 is a steering wheel and is

connected with the axle 7 through the uniform universal joint 6. rotation of a wheel 1 -- a member 8 -- the composition of a wheel 1 -- the thing of a member which is combined with a member and a wheel 1, and one, and rotates -- it is -- this example -- a hub -- outer-ring-of-spiral-wound-gasket 6a of a ring 3 and the uniform universal joint 6 is included the uniform universal joint 6 -- outer-ring-of-spiral-wound-gasket 6a -- the hub of the axle bearing 2 -- it is really combined with the ring 3 by the fixed state

[0012] A brake 9 brakes a wheel 1 in contact with friction members (not shown), such as a brake drum prepared in the wheel 1, or a brake disc, and is equipped with the oil hydraulic cylinder etc. Energizing of the operation of the brake operating member 10, such as a brake pedal, is changed and carried out to the oil pressure force etc. through the conversion means 11, and it is told to a brake 9. The damping force adjustment means 12 is a means to adjust the damping force of a brake 9, and adjusts damping force according to instructions of a control circuit 13. The damping force adjustment means 12 is formed in the oil pressure path between a brake 9 and the conversion means 11. A control circuit 13 is a means to give adjustment instructions of damping force to the damping force adjustment means 12 according to the wheel rotational frequency detected by the sensor 14 of a rotational frequency, and consists of electronic circuitries, such as a microcomputer.

[0013] A sensor 14 stands face to face against the pulser ring 15 of a wheel 1, is installed in the wheel supporter material 4, detects the pulser ring 15, and outputs a pulse number. the pulser ring 15 -- rotation of a wheel 1 -- it is prepared in the member 8. the example of illustration -- the pulser ring 15 -- outer-ring-of-spiral-wound-gasket 6a of the uniform universal joint 6 -- detailed -- the hub of outer-ring-of-spiral-wound-gasket 6a -- it is prepared in the connection edge with a ring 3 the parts with which the pulser ring 15 makes a sensor 14 generate a pulse output with rotation -- it is -- an outer-diameter side -- a pulse -- things of various kinds of composition according to the sensor 14, such as what prepared the row of teeth (example of drawing 6), a thing (example of drawing 4) in which the magnetic pole opposite to a circumferencial direction by turns arranged, and was prepared, and a thing (not shown) on a par with a circumferencial direction by turns which prepared the grid of a detectable shade optically, are used

[0014] The detecting signal of a sensor 14 is transmitted to a control circuit 13 through a wireless means of communication 16. A wireless means of communication 16 consists of the transmitting section 17 installed in the wheel supporter material 4, and a receive section 18 installed in the body 5. A receive section 18 counters mutually the interior of tire house section 5a in the body 5 with the transmitting section 17, and is prepared in it.

[0015] The signal which transmits space should just be used for a wireless means of communication 16 for what performs transmission by light, such as transmission not only by an electric wave but magnetic coupling, and infrared radiation, or transmission by the ultrasonic wave. In magnetic coupling **** transmission, the signal transmission of the wireless means of communication 16 shall be carried out by the magnetic coupling between

the transmitting coil prepared in the transmitting section 17, and the receiver coil prepared in the receive section 18. A transmitting coil is excited on the frequency of arbitration and makes a receiver coil generate voltage in electromagnetic induction. In transmission by the ultrasonic wave. the signal transmission of the wireless means of communication 16 shall be carried out ultrasonically. In this case, it is made to oscillate by ultrasonic vibrators, such as a piezoelectric device. and the transmitting section 17 modulates and transmits the ultrasonic wave by the signal of a sensor. 20kHz or more exceeding a audio range is used for frequency. In transmission by light, the signal transmission of the wireless means of communication 16 shall be carried out with light, such as infrared radiation and a visible ray. In this case, the transmitting section 17 turns light emitting devices, such as a laser diode and Light Emitting Diode, to the interior of tire house 5a of the body 5, arranges them, and turns and arranges photo detectors, such as a photodiode and a photo transistor, as a receive section 18 into the body 5 at the transmitting section 17 side. In transmission by the electric wave, the signal transmission of the wireless means of communication 16 shall be carried out by the feeble electric wave. Let this feeble electric wave be the electric wave (500micro below of field strength [For example, a 322Mz board 3m distance] V) which does not receive regulation of Wireless Telegraph Law. In this case, a signal is transmitted by turning on and off and frequency modulation of an electric wave.

[0016] The signal which is transmitted from the transmitting section 17 in the case of the wireless means of communication 16 of each above-mentioned composition (i.e., the case of magnetic coupling, an ultrasonic wave, light, and the wireless means of communication 16 transmitted by any of a feeble electric wave) may be a simple on-off signal, and may modulate a subcarrier by the signal of a sensor 14. When modulating a subcarrier, a receive section 18 makes it receive [align it and] and restore to the signal transmitted in the transmitting section 17. The modulation of a subcarrier may turn a subcarrier on and off, and may carry out frequency modulation of the subcarrier. Thus, when modulating a subcarrier and carrying out the alignment recovery of this, the influence of an external noise can be mitigated.

[0017] Drawing 2 shows the example of the wireless means of communication 16 made into magnetic coupling. The transmitting section 17 consists of an oscillation, a modulation circuit 19, and a transmitting coil 20. The transmitting coil 20 has a magnetic core. An oscillation and a modulation circuit 19 consist of an oscillator circuit which oscillates the subcarrier of predetermined frequency (for example, 1MHz), and a modulation circuit which modulates the oscillated subcarrier with the output of a sensor 14. Electric supply to a sensor 14, and an oscillation and a modulation circuit 19 is performed from the transmitting section power supply 23. A receive section 18 consists of a receiver coil 22 by which magnetic coupling was carried out to the transmitting coil 20, and an alignment demodulator circuit 21 which aligns and restores to an input signal. A receiver coil 22 has a magnetic core. Distance L of the transmitting coil 20 and a receiver coil 22 is set to about 40cm.

[0018] Although the modulation techniques of an oscillation and a modulation circuit 19 may

be arbitrary methods, they turn the output of the oscillator-circuit section on and off using the output of a sensor 14, and are controlling the current which flows in the transmitting coil 20 here. It comes to indicate it in drawing 3 as the voltage (sending signal) concerning the transmitting coil 20, and the input signal obtained from a receiver coil 22 by the alignment demodulator circuit 21. If AM recovery of the input signal is carried out, the pulse output of the sensor 14 which is a rotation sensor will be obtained.

[0019] Let the transmitting section power supply 23 be a generator using rotation of a wheel, or the below-mentioned wireless electric supply means. When considering as the generator using rotation of a wheel, the signal of a sensor 14 can be transmitted without carrying out an electric power supply separately. this generator -- the hub of a wheel 1 -- it builds near the section This generator is good also as a thing only for power supplies, and good also as what makes a sensor serve a double purpose.

[0020] When considering as a generator, the pulser ring 15 shown in drawing 1 is set to ring magnet 15for power generation A as shown in drawing 4 , and a sensor 14 is set to generator coil 14A. Generator 23A consists of ring magnet 15A for these power generation, and a sensor 14. When ring magnet 15A rotates with a wheel 1, alternating field are made to generator coil 14A, and this coil 14A is made to generate an induced voltage. By rectifying this generated alternating voltage, it considers as the power supply of the transmitting section 17 (drawing 1) and a sensor 14. This generator 23A is good also as what serves as a rotation sensor also as only for power supplies. When carrying out to power supplies only, as shown in drawing 7 , the pulser ring 15 and the sensor 14 for rotation detection corresponding to this are formed separately, and the output of generator 23A is used as a power supply of the transmitting section 17 and a sensor 14.

[0021] Generator 23A explained with drawing 4 can use the frequency of generator 23A as a rotational frequency detecting signal as it is, without preparing a rotation sensor separately by making the number of magnetic poles into a pulse number required as a rotation sensor of anti-lock brake equipment. Drawing 4 (B) shows the state where ring magnet 15A for power generation rotated only angle of rotation for one pole from the state of drawing 4 (A). In drawing 4 , the sign of N and S shows a magnetic pole and Arrow a shows the direction of a magnetic field respectively. Since this generator 23A can generate the alternating voltage of the frequency which multiplied by the number of pole pairs of this ring magnet 15A in the rotational frequency of ring magnet 15A, it uses voltage after rectification as the power supply of the transmitting section 17, and can use the number of ac cycles for it as a rotational frequency detection value.

[0022] The example of a circuit of the transmitting section 17 in the case of making the sensor of a rotational frequency serve a double purpose by generator 23A is shown in drawing 5 . In this circuit, while power of AC-generator 23A which synchronized with the wheel rotational frequency is direct-current-ized by the rectifier circuit 25 and serves as the power supply Vdd of oscillator-circuit 19a, modulation circuit 19b, and the transmitting coil 20, the transistor 27

for output turning on and off which constitutes modulation circuit 19b is driven, and the output modulation which synchronized with the rotational frequency is performed. At the time of a rotation fall. the power accumulated at the mass capacitor or rechargeable battery 26 of a rectifier circuit 25 at the time of a run is using as circuit drive power, and makes detection possible to the low speed field at the time of a slowdown. Oscillator circuit 19a and modulation circuit 19b constitute an oscillation and the modulation circuit 19 of drawing 2 .

[0023] Below. the example which makes the transmitting section power supply 23 of drawing 2 a wireless electric supply means is explained with drawing 8 . That is, wireless electric supply means 23B which gives power required for the transmitting section 17 and the sensor 14 of a wireless means of communication 16 by wireless from a body 5 side is prepared. This wireless electric supply means 23B counters mutually the body 5 and the wheel supporter material 4, and prepares in them the transmitting section 31 and the receive section 32 which send and receive the power of the power supply 30 installed in the body 5 by wireless. Thus, by preparing wireless electric supply means 23B, the electric wire for electric supply is not exposed outside a vehicle between the wheel supporter 4 and the body 5, and the problem of an open circuit of this electric wire for electric supply is also solved. Moreover, unlike the case where a generator is formed; electric power can be supplied also at the time of a body halt, and a zero prompt speed signal can be acquired.

[0024] Wireless electric supply means 23B is also depended on magnetic coupling, and also it transforms power into light, an ultrasonic wave, an electric wave, etc., and can perform transfer of the power by wireless. By wireless electric supply means 23B, whether it considers as which transfer method by magnetic coupling, light, the ultrasonic wave, the electric wave, etc. is considering as the same method as the transfer method adopted with the wireless means of communication 16 of a sensor signal, and it can attain part communalization of wireless electric supply means 23B and a wireless means of communication 16, and communalization of handling.

[0025] When considering wireless electric supply means 23B as transmission by magnetic coupling, a receiver coil is made to generate voltage in electromagnetic induction by arranging a transmitting coil as the transmitting section 31, arranging a receiver coil as a receive section 32 into the body 5, at the wheel supporter material 4, and exciting the transmitting coil by the side of the body on arbitrary frequency. When the magnetic coupling force is weak and required power is not obtained at this time, the magnetic coupling force can also be raised by using the body mechanism section which combines the body 5 and the wheel supporter material 4. such as a link bar and a shock absorber, as a magnetic core. Moreover, the coil for transmission and the coil for reception can also share the same coil by power and the signal by dividing the frequency the object for power, and for signals.

[0026] When considering wireless electric supply means 23B as transmission by light, into the body 5, as the transmitting section 31, light emitting devices, such as a laser diode and Light Emitting Diode, are turned to the wheel supporter material 4, and are arranged, and to the

wheel supporter material 4, the elements (solar battery etc.) which have the photovoltaic effect as a receive section 32 are turned to the transmitting section 31, and are arranged. Thereby, power can be transmitted to the wheel supporter material 4 with light from the body 5.

[0027] When considering wireless electric supply means 23B as transmission by the ultrasonic wave, in response to an ultrasonic wave, it changes into power by the receive section 32, using a ultrasonic vibrator as the transmitting section 31. In addition, when based on an ultrasonic wave, unlike the case where it is based on magnetic coupling, the above-mentioned body mechanism section cannot be used for transfer.

[0028] When considering wireless electric supply means 23B as transmission by the electric wave, since it is not behind in power by the feeble electric wave unlike a signal, microwave (3GHz - about 5GHz) is used. A microwave transmitter is installed in the body 5 as the transmitting section 31, and a receiving antenna and a rectifier are formed in the wheel supporter material 4 as a receive section 32. This performs a transfer of power. Since directivity is high, microwave is still more efficient when it is made for the transmitting section 31 and a receive section 32 to always face each other using a link bar etc.

[0029]

[Effect of the Invention] The signal of a rotation sensor is written as what is sent and received from the transmitting section of wheel supporter material by wireless to the receive section by the side of the body, and, as for the anti-lock brake equipment of this invention, an electric wire does not expose it outside a vehicle between a wheel supporter and the body. Therefore, trouble of an open circuit is not caused by the freeze of the snow in stone splashes or a tire house etc. Moreover, since the electric wire for the sensor signals between a wheel supporter and the body can be excluded and the complicated wiring fixed work also becomes unnecessary, lightweight-izing of an automobile and a cost fall can be aimed at.

[Translation done.]

(19)日本国特許庁（ＪＰ） (12) 公開特許公報（A） (11)特許出願公開番号
特開2000－329593
（P2000－329593A）
(43)公開日 平成12年11月30日(2000.11.30)

(51)Int.Cl.'	識別記号	ＦＩ	ﾃｰﾏｺｰﾄﾞ(参考)
Ｇ０１Ｄ 21/00		Ｇ０１Ｄ 21/00	Ｍ ２Ｆ０７６

審査請求 未請求 請求項の数５ ＯＬ （全 ７ 頁）

(21)出願番号 特願平11－141231

(22)出願日 平成11年５月21日(1999.5.21)

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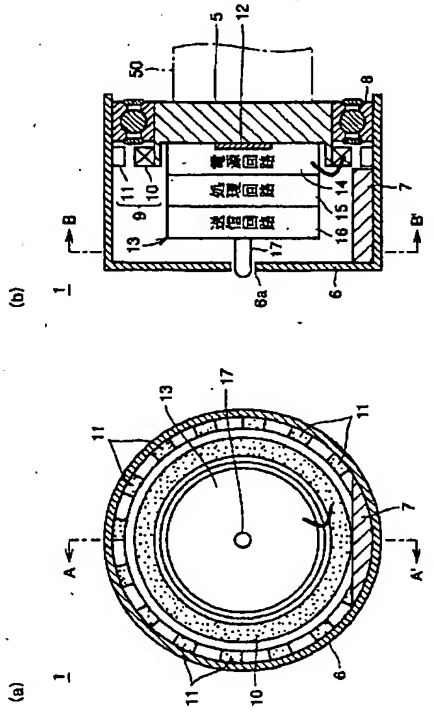
Ｆターム(参考) 2F076 BA01 BD07 BD12 BE18 BE19

(54)【発明の名称】 回転体状態検出装置

(57)【要約】
【課題】 信頼性が高くコンパクトな回転体状態検出装置を提供する。
【解決手段】 検出器１は、回転軸５０とともに回転する内蓋５と、錘７および軸受８によって回転が防止される外蓋６と、内蓋５に設けられたコイル１０と外蓋６に設けられた磁石１１とを含む発電機９と、振動センサ１２の検出結果を送信する回路ユニット１３および発光素子１７とを備える。配線およびスリップリングが不要であるので、信頼性の向上および装置のコンパクト化が図られる。



【特許請求の範囲】
【請求項１】　回転体に取付けられ、前記回転体の振動、温度、回転数などを検出するための回転体状態検出装置であって、
その中心軸が前記回転体の中心軸と一致するようにしてその一方端面が前記回転体に固定される円板状の内蓋、
その内周面の一部が前記内蓋の外周面に対向させて配置される外蓋、
前記内蓋と前記外蓋の間に挿嵌され、前記外蓋の回転を防止するための軸受、
前記内蓋および前記外蓋のうちのいずれか一方に設けられた磁石と他方に設けられたコイルとを含み、前記内蓋と前記外蓋の回転速度の差に応じた電力を生成する発電機、および前記発電機によって生成された電力によって駆動され、前記回転体の振動、温度、回転数などを検出する検出手段を備える、回転体状態検出装置。
【請求項２】　さらに、前記外蓋に設けられ、前記外蓋の回転を防止するための所定の重量を有する錘部材を備える、請求項１に記載の回転体状態検出装置。
【請求項３】　さらに、前記発電機によって生成された電力によって駆動され、前記検出手段の検出結果を送信するための送信手段を備える、請求項１または請求項２に記載の回転体状態検出装置。
【請求項４】　さらに、前記発電機によって生成された電力によって駆動され、前記検出手段の検出結果を表示するための表示手段を備える、請求項１から請求項３のいずれかに記載の回転体状態検出装置。
【請求項５】　さらに、前記内蓋の一方端面に固定され、前記内蓋を前記回転体に取付けるための永久磁石を備える、請求項１から請求項４のいずれかに記載の回転体状態検出装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】この発明は回転体状態検出装置に関し、特に、回転体に取付けられ、回転体の振動、温度、回転数などを検出するための回転体状態検出装置に関する。
【０００２】
【従来の技術】従来より、自動車産業や鉄鋼産業の分野では、回転部の状態（振動、温度、回転数、トルクなど）を検出するため、種々の検出装置が用いられている。
【０００３】図１４は、回転軸５０の振動を検出するための振動検出装置の構成を示すブロック図である。図１４において、この振動検出装置は、回転軸５０の端部に外挿されて固定された４つのスリップリング５１～５４と、回転軸５０の端部に取付けられた検出器５５と、配線Ｌ１，Ｌ２，Ｌ１１，Ｌ１２およびスリップリング５１，５２を介して検出器５５に接続された電源５６と、配線Ｌ３，Ｌ４，Ｌ１３，Ｌ１４およびスリップリング５３，５４を介して検出器５５に接続された表示装置５７とを備える。
【０００４】電源５６から配線Ｌ１，Ｌ２，Ｌ１１，Ｌ１２およびスリップリング５１，５２を介して検出器５５に電源電圧が供給される。検出器５５は、振動センサと、その出力信号を増幅するためのアンプとを含む。アンプの出力信号は、配線Ｌ１３，Ｌ１４，Ｌ３，Ｌ４およびスリップリング５３，５４を介して表示装置５７に与えられる。表示装置５７には、回転軸５０の振動状態がアナログ表示またはデジタル表示される。
【０００５】
【発明が解決しようとする課題】しかし、従来の振動検出装置では、スリップリング５１～５４や配線Ｌ１～Ｌ４，Ｌ１１～Ｌ１４を用いていたので、ノイズが大きく信頼性が低いという問題があった。また、スリップリング５１～５４および配線Ｌ１～Ｌ４，Ｌ１１～Ｌ１４によって占められるスペースが大きいという問題もあった。
【０００６】それゆえに、この発明の主たる目的は、信頼性が高くコンパクトな回転体状態検出装置を提供することである。
【０００７】
【課題を解決するための手段】請求項１に係る発明は、回転体に取付けられ、回転体の振動、温度、回転数などを検出するための回転体状態検出装置であって、その中心軸が回転体の中心軸と一致するようにしてその一方端面が回転体に固定される円板状の内蓋と、その内周面の一部が内蓋の外周面に対向させて配置される外蓋と、内蓋と外蓋の間に挿嵌され、外蓋の回転を防止するための軸受と、内蓋および外蓋のうちのいずれか一方に設けられた磁石と他方に設けられたコイルとを含み、内蓋と外蓋の回転速度の差に応じた電力を生成する発電機と、発電機によって生成された電力によって駆動され、回転体の振動、温度、回転数などを検出する検出手段を備えたものである。
【０００８】請求項２に係る発明では、請求項１に係る発明に、外蓋に設けられ、外蓋の回転を防止するための所定の重量を有する錘部材がさらに設けられる。
【０００９】請求項３に係る発明では、請求項１または２に係る発明に、発電機によって生成された電力によって駆動され、検出手段の検出結果を送信するための送信手段がさらに設けられる。
【００１０】請求項４に係る発明では、請求項１から３のいずれかに係る発明に、発電機によって生成された電力によって駆動され、検出手段の検出結果を表示するための表示手段がさらに設けられる。
【００１１】請求項５に係る発明では、請求項１から４のいずれかに係る発明に、内蓋の一方端面に固定され、内蓋を回転体に取付けるための永久磁石がさらに設けられる。

【００１２】
【発明の実施の形態】［実施の形態１］図１は、この発明の実施の形態１による振動検出装置の構成を示すブロック図である。図１において、この振動検出装置は、回転軸５０の端面に取付けられた検出器１と、検出器１から出射された光信号を受信する受信機２と、受信機２の出力信号に従って回転軸５０の振動状態を表示する表示装置３とを備える。
【００１３】図２（ａ）（ｂ）は検出器１の構成を示す断面図であり、特に、同図（ａ）は同図（ｂ）のＢ－Ｂ′線断面図であり、同図（ｂ）は同図（ａ）のＡ－Ａ′線断面図である。図２（ａ）（ｂ）において、検出器１は、その中心軸が回転軸５０の中心軸と一致するようにしてその一方端面が回転軸５０の端面に固定された円板状の内蓋５と、その内周面が内蓋５の外周面に対向して配置されたコップ状の外蓋６と、外蓋６の内周面の一部に設けられた錘７と、内蓋５の外周面と外蓋６の内周面との間に挿嵌された軸受８とを含む。
【００１４】内蓋５は、回転軸５０とともに回転する。軸受８は、内蓋５の回転運動が外蓋６に伝達されるのを防止する。軸受８は、玉軸受、コロ軸受、滑り軸受の他、どのような軸受でもよい。錘７は、軸受８を介し僅かに伝達される回転トルクを打ち消して、外蓋６が回転するのを防止する。
【００１５】また検出器１は、アニュラセンサ型発電機９、圧電型振動センサ１２、回路ユニット１３、および発光素子１７を含む。発電機９は、内蓋５の外周面に設けられたアニュラセンサ用コイル１０と、コイル１０に対向して外蓋６の内周面に設けられた複数の永久磁石１１とを含む。コイル１０は、コの字型の歯状の端面を有する。複数の永久磁石１１は、コイル１０に対向する方の磁極が交互にＮ極およびＳ極になるようにして所定のピッチで配置される。
【００１６】永久磁石１１によって固定磁界が形成され、その固定磁界中をコイル１０が移動することによりコイル１０内に磁束変化が生じ、これにより回転軸５０の回転速度に応じた交流電圧Ｖ９がコイル１０に発生する。
【００１７】圧電型振動センサ１２は、内蓋５の他方端面に設けられ、内蓋５を介して回転軸５０の振動を検出し、検出結果に応じたレベルの電気信号を出力する。
【００１８】回路ユニット１３は、電源回路１４、処理回路１５および送信回路１６を含む。電源回路１４は、図３に示すように、整流器２０、平滑器２１、蓄電器２２、および安定器２３を含む。整流器２０は、図４（ａ）（ｂ）（ｃ）に示すように、発電機９の出力電圧Ｖ９を全波整流する。平滑器２１は、コンデンサおよびコイルを含み、整流器２０の出力電圧Ｖ２０を平滑化して直流電圧Ｖ２１を生成する。蓄電器２２は、平滑器２１の出力端子に接続される。蓄電器２２は、発電機９の出力電圧Ｖ９は回転軸５０の回転速度によって変動するので、回転軸５０の回転速度によらず一定電圧を供給するための充放電回路を含む。安定器２３は、平滑器２１および蓄電器２２の出力電圧を受け、電圧変動のない一定の直流電圧Ｖ１３を出力する。直流電圧Ｖ１３は、回路ユニット１３全体に与えられる。
【００１９】処理回路１５は、図５に示すように、センサアンプ２５、基本信号除去回路２６、絶対値回路２７、および比較回路２８を含む。センサアンプ２５は、センサ１２の出力を増幅して、後処理を容易にする。基本信号除去回路２６は、センサアンプ２５の出力信号から基本正弦波成分を除去し、異常振動成分のみを絶対値回路２７に与える。絶対値回路２７は、基本信号除去回路２６から与えられた振動信号の振幅（絶対値）を検出する。比較回路２８は、予め定められたしきい値と振動信号の振幅値とを比較し、振動信号の振幅値がしきい値よりも小さい期間は振動が正常であることを示す「Ｌ」レベルの信号を出力し、振動信号の振幅値がしきい値よりも大きい期間は振動が異常であることを示す「Ｈ」レベルの信号を出力する。
【００２０】送信回路１６は、比較回路２８の出力信号に従って搬送波を変調し、被変調波によって発光素子１７を駆動する。発光素子１７は、たとえば半導体レーザまたはＬＥＤであり、図２に示すように、検出器１の中心軸に設けられる。外蓋６の中央部に貫通孔６ａが開口されており、発光素子１７はその貫通孔６ａに挿入される。回転軸５０の中心軸と検出器１の中心軸は一致しているので、回転軸５０が回転しても発光素子１７の位置は変化しない。発光素子１７から出射された光信号は、受信機２に与えられる。
【００２１】受信機２は、図５に示すように、受光素子２９と受信回路３０を含む。受光素子２９は、発光素子１７からの光信号を電気信号に変換して受信回路３０に与える。受信回路３０は、受光素子２９から与えられた電気信号を復調して表示装置３に与える。表示装置３は、受信回路３０から与えられた信号に従って、回転軸５０の振動が正常か否かをアナログ表示またはデジタル表示する。
【００２２】次に、この振動検出装置の動作について説明する。回転軸５０が回転駆動されると、検出器１の内蓋５も回転駆動される。内蓋５と外蓋６の間には軸受８が設けられており、また外蓋６の一部には錘７が設けられているので、外蓋６は回転しない。これにより、発電機９の磁石１１で生成された固定磁界中をコイル１０が移動することとなり、発電機９によって交流電圧Ｖ９が生成される。コイル電圧Ｖ９は、電源回路１４によって整流および平滑化されて直流電圧Ｖ１３に変換される。この直流電圧Ｖ１３は、電源電圧として回路ユニット１３全体に与えられる。
【００２３】振動センサ１２の出力は処理回路１５に与

えられ、処理回路１５によって回転軸５０の振動が正常か否かが判定される。送信回路１６は、処理回路１５の判定結果に従って発光素子１７を駆動する。発光素子１７から出射された光信号は、受信機２に与えられる。光信号は、受信機２によって復調されて表示装置３に与えられ、回転軸５０の振動が正常か否かが表示装置３に表示される。

【００２４】この実施の形態では、内蓋５を回転軸５０の端面に固定して内蓋５を回転軸５０とともに回転させる一方、内蓋５と外蓋６の間に軸受８を設けるとともに外蓋６に錘を設けて外蓋６の回転を防止し、内蓋５と外蓋６の回転速度の差を利用して電源電圧を生成する。したがって、従来のように外部電源５６から検出器５５に電源電圧を供給するための配線Ｌ１，Ｌ２，Ｌ１１，Ｌ１２およびスリップリング５１，５２は不要となる。また、センサ１２の検出結果を検出器１から受信機２へ光信号で送信するので、従来のように検出器５５から表示装置５７へ検出結果を伝達するための配線Ｌ１３，Ｌ１４，Ｌ３，Ｌ４およびスリップリング５３，５４も不要となる。したがって、配線Ｌ１～Ｌ４，Ｌ１１～Ｌ１４およびスリップリング５１～５４に起因するノイズがなくなり、また、検出装置によって占められるスペースも小さくて済む。

【００２５】なお、この発明は、回転部を備えたすべてのものに適用可能である。たとえば、回転軸を備えた製造装置、自動車の足まわり回転部（ホィール、ハブ、ジョイント、プロペラシャフト、デフなど）、圧延ローラに適用可能である。

【００２６】また、この実施の形態では、回転軸５０の振動を検出したが、これに限るものではなく、この発明は回転軸５０の温度、回転数、トルクなどの検出にも適用可能であることはいうまでもない。ただし、センサ１２は、検出対象に応じたものと交換する必要がある。

【００２７】以下、この実施の形態１の変更例について説明する。図６の変更例では、発光素子１７が送信用のアンテナ３１で置換される。ただし、この場合は、受信機２には受光素子２９の代わりに受信用のアンテナを設ける必要がある。

【００２８】図７の変更例では、図２の発光素子１７は、固定部材３２を介して外蓋６の貫通孔６ａに固定される。回路ユニット１３にスリップリング３３が固定され、送信回路１６の出力信号がスリップリング３３を介して発光素子１７に与えられる。

【００２９】図８の変更例では、図６のアンテナ３１は、固定部材３４を介して外蓋６の貫通孔６ａに固定される。回路ユニット１３にスリップリング３３が固定され、送信回路１６の出力信号はスリップリング３３を介してアンテナ３１に与えられる。

【００３０】図９の変更例では、図２の内蓋５の一方端面（センサ１２と反対側の端面）に、内蓋５を回転軸５０の端面に取付けられるための円板状の永久磁石３５が固定される。この場合は、本装置の回転軸５０への取付および取外しが容易になる。

【００３１】図１０（ａ）（ｂ）の変更例では、外蓋６が円板部材６ｂと円筒部材６ｃに分割され、円板部材６ｂは支持部材３６を介して回路ユニット１３に固定される。円板部材６ｂの外側表面に円板部材６ｂの中心から外周面に向かって複数のＬＥＤ３７が１列に配置される。送信回路１６は、回転軸５０の回転に同期して複数のＬＥＤ３７の各々を個別に駆動し、回転軸５０の振動状態を残像現象を利用して文字表示する。この場合は、検出器自体が回転軸５０の振動状態を文字表示するので、受信機２および表示装置３は不要となる。

【００３２】［実施の形態２］図１１（ａ）（ｂ）は、この発明の実施の形態２による振動検出装置の検出器４１の構成を示す断面図であり、特に、同図（ａ）は同図（ｂ）のＥ－Ｅ′線断面図、同図（ｂ）は同図（ａ）のＤ－Ｄ′線断面図である。

【００３３】図１１（ａ）（ｂ）を参照して、この検出器４１が図２の検出器１と異なる点は、回路ユニット１３が外蓋６に固定され、発光素子１７が固定部材３２を介して外蓋６の貫通孔６ａに固定され、発電機９が発電機４３で置換され、スリップリング４２が新たに設けられている点である。

【００３４】スリップリング４２は、内蓋５の他方端面に形成された凹部の内周面に固定される。振動センサ１２は、スリップリング４２を介して処理回路１５に接続される。発電機４３は、内蓋５の外周面に設けられた複数の磁石４４と、磁石４４に対向して外蓋６の内周面に設けられたコイル４５とを含む。複数の磁石４４は、コイル４５に対向する方の磁極が交互にＮ極およびＳ極になるようにして所定のピッチで配置される。コイル４５は、コの字型の歯状の端面を有する。コイル４５は、電源回路１４に接続される。

【００３５】次に、この振動検出装置の動作について説明する。回転軸５０が回転駆動されると、検出器４１の内蓋５も回転駆動される。錘７および軸受８により、外蓋６の回転が防止される。これにより、発電機４３の磁石４４で生成された磁界中をコイル４５が相対的に移動することとなり、発電機４３によって交流電圧が生成される。コイル電圧は電源回路１４によって直流電圧に変換されて回路ユニット１３全体に供給される。

【００３６】振動センサ１２の出力はスリップリング４２を介して処理回路１５に与えられ、処理回路１５によって回転軸５０の振動が正常か否かが判定される。送信回路１６は、処理回路１５の判定結果に従って発光素子１７を駆動する。他の構成および動作は、実施の形態１と同じであるので、その説明は繰返さない。

【００３７】この実施の形態２でも、実施の形態１と同じ効果が得られる。なお、図１２に示すように、発光素

子１７をアンテナ３１で置換してもよいし、図１３に示すように検出器を回転軸５０の端面に取付けるための円板状の永久磁石３５を内蓋５に固定してもよい。

【００３８】なお、今回開示された実施の形態は全ての点で例示であって、制限的なものではないと考えられるべきである。本発明の範囲は上記した説明ではなくて特許請求の範囲によって示され、特許請求の範囲と均等の意味および範囲内でのすべての変更が含まれることが意図される。

【００３９】

【発明の効果】以上のように、請求項１に係る発明では、回転体に固定される円板状の内蓋と、円筒部材を含む外蓋と、内蓋と円筒部材の間に挿嵌された軸受と、内蓋および外蓋の一方に設けられた磁石と他方に設けられたコイルとを含む発電機と、発電機で生成された電力で駆動され、回転体の振動などを検出する検出手段とが設けられる。したがって、外部から電源電圧を供給する必要がないので、配線およびスリップリングが少なくて済む。よって、配線およびスリップリングに起因するノイズを低減化でき、信頼性の向上を図ることができる。また、配線およびスリップリングによって占められていたスペースの縮小化を図ることができる。

【００４０】請求項２に係る発明では、請求項１に係る発明の外蓋に、外蓋の回転を防止するための所定の重量を有する錘部材がさらに設けられる。この場合は、外蓋の回転が確実に防止される。

【００４１】請求項３に係る発明では、請求項１または２に係る発明に、発電機によって生成された電力によって駆動され、検出手段の検出結果を送信するための送信手段がさらに設けられる。この場合は、検出手段の検出結果を取出すための配線およびスリップリングも不要となり、信頼性の一層の向上およびスペースの一層の縮小化を図ることができる。

【００４２】請求項４に係る発明では、請求項１から３のいずれかに係る発明に、発電機によって生成された電力によって駆動され、検出手段の検出結果を表示するための表示手段がさらに設けられる。この場合も、検出手段の検出結果を取出すための配線およびスリップリングも不要となり、信頼性の一層の向上およびスペースの一層の縮小化を図ることができる。

【００４３】請求項５に係る発明では、請求項１から４のいずれかに係る発明に、内蓋の一方端面に固定され、内蓋を回転体に取付けるための永久磁石がさらに設けられる。この場合は、検出装置の回転体への着脱が容易になる。

【図面の簡単な説明】

【図１】図１は、この発明の実施の形態１による振動検出装置の構成を示すブロック図である。

【図２】図１に示した検出器の構成を示す断面図であって、図２（ａ）は図２（ｂ）のＢ－Ｂ′線断面図、図２（ｂ）は図２（ａ）のＡ－Ａ′線断面図である。

【図３】図２に示した電源回路の構成を示すブロック図である。

【図４】図３に示した電源回路の動作を示すタイムチャートである。

【図５】図１に示した振動検出回路の構成を詳細に示すブロック図である。

【図６】実施の形態１の変更例を示す断面図である。

【図７】実施の形態１の他の変更例を示す断面図である。

【図８】実施の形態１のさらに他の変更例を示す断面図である。

【図９】実施の形態１のさらに他の変更例を示す断面図である。

【図１０】実施の形態１のさらに他の変更例を示す図であって、図１０（ａ）は検出器の正面図、図１０（ｂ）は図１０（ａ）のＣ－Ｃ′線断面図である。

【図１１】この発明の実施の形態２による振動検出装置の検出器の構成を示す断面図であって、図１１（ａ）は図１１（ｂ）のＥ－Ｅ′線断面図、図１１（ｂ）は図１１（ａ）のＤ－Ｄ′線断面図である。

【図１２】実施の形態２の変更例を示す断面図である。

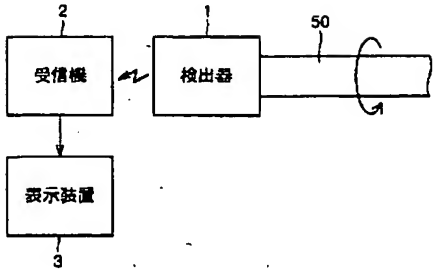
【図１３】実施の形態２の他の変更例を示す断面図である。

【図１４】従来の振動検出装置の構成を示すブロック図である。

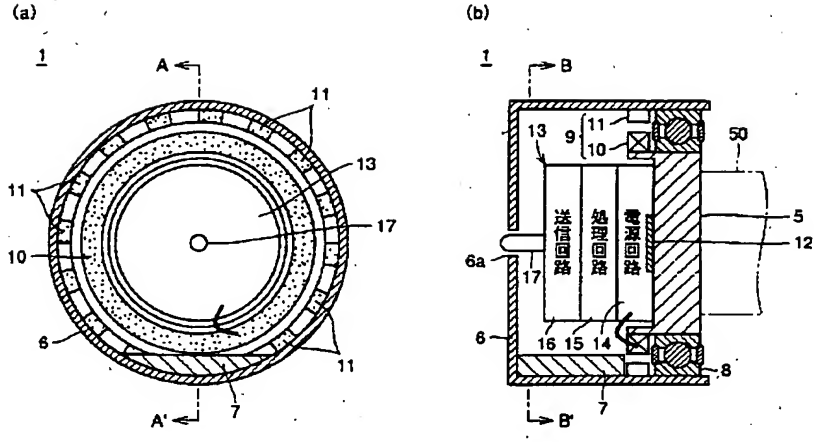
【符号の説明】

１　検出器
２　受信機
３　表示装置
５　内蓋
６　外蓋
７　錘
８　軸受
９，４３　発電機
１０，４５　コイル
１１，３５，４４　永久磁石
１２　振動センサ
１３　回路ユニット
１４　電源回路
１５　処理回路
１６　送信回路
１７　発光素子
３１　アンテナ
３３，４２　スリップリング
３７　ＬＥＤ
５０　回転軸

【図１】



【図２】



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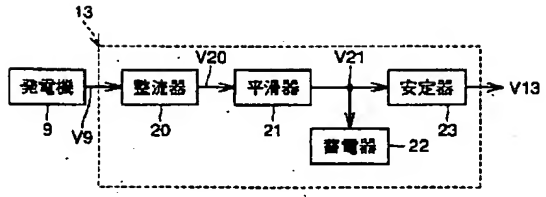

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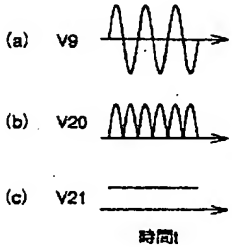

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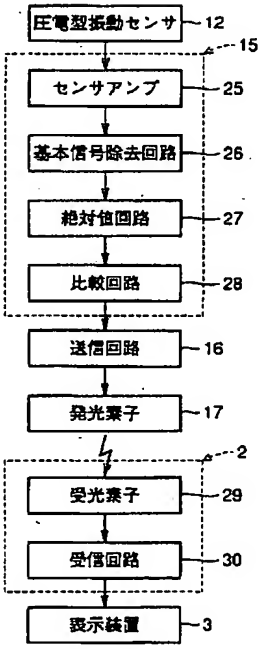

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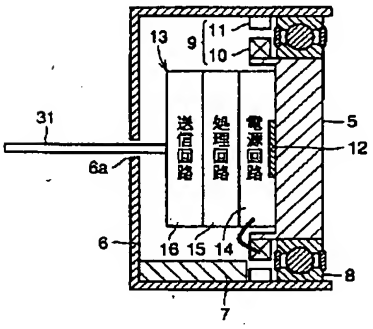

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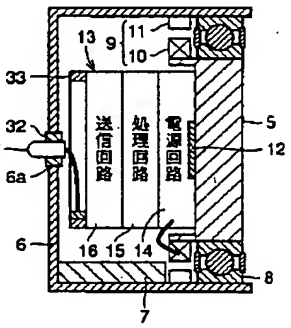

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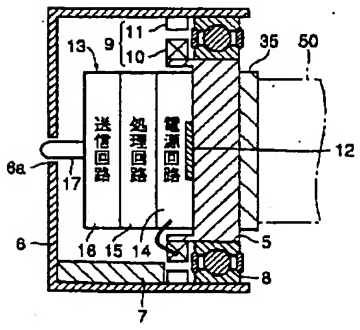

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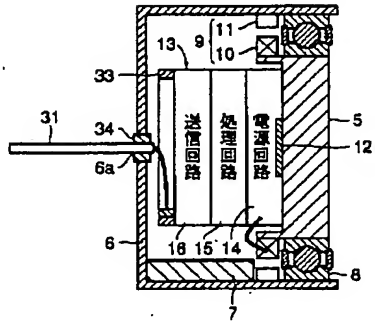

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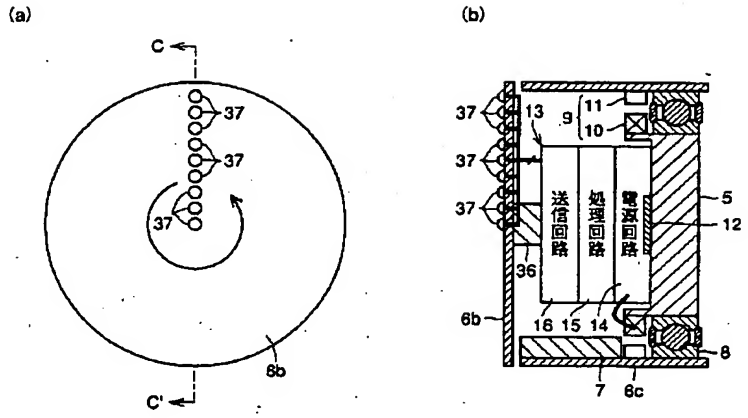
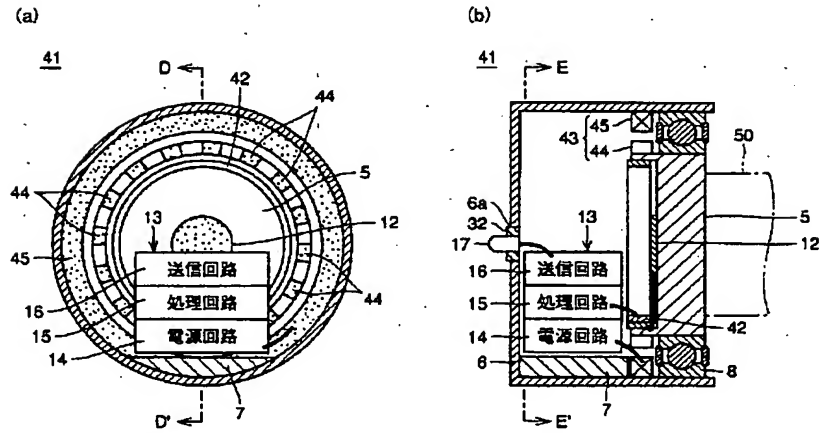


【図１１】



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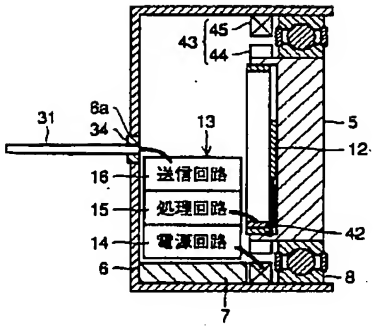

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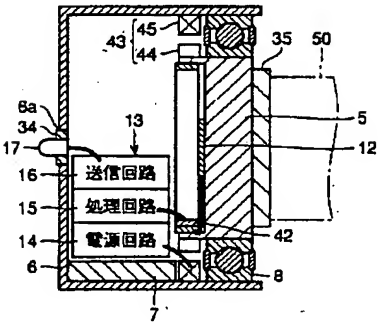
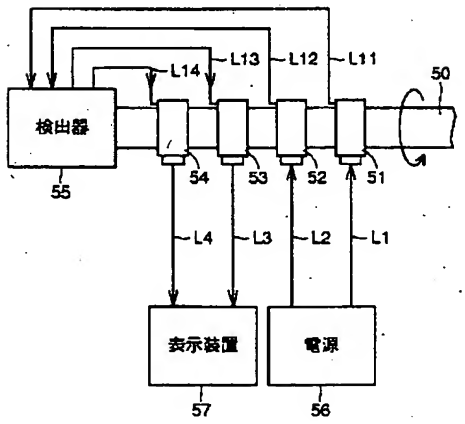


【図１４】



PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-151090
(43)Date of publication of application : 05.06.2001

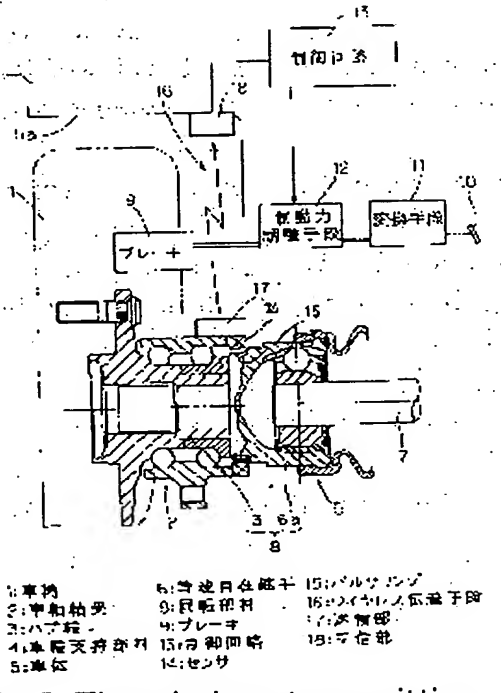
(51)Int.CI. B60T 8/00
B60T 8/34
G08C 17/02
G08C 19/00
G08C 23/02
G08C 23/04
// G01P 3/487
G01P 3/488

(21)Application number : 11-339588
(22)Date of filing : 30.11.1999

(71)Applicant : NTN CORP
(72)Inventor : OKADA KOICHI

(54) ANTILOCK BRAKING SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an antilock braking system that involves no fear of disconnection on the automobile exterior and promotes a reduction in the weight and cost of the automobile.
SOLUTION: A vehicle body 5 has a control circuit 13 for controlling the braking force of a brake 9 on the basis of detection signals showing wheel rotating speed. A rotary member 8 for a wheel 1 is mounted with a pulser ring 15, in opposition to which a sensor 14 for speed detection is mounted on a wheel support member 4. The output of the sensor 14 is transmitted by means of wireless transmitting means 16 that consist of a transmitting section 17 arranged on the wheel support member 4 and a receiving section 18 disposed on the vehicle body 5. The wireless transmitting means 16 may employ transmission by magnetic coupling, light such as infrared rays, or ultrasonic waves other than radio waves.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

2001-151090

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the anti-lock brake equipment in an automobile.
[0002]
[Description of the Prior Art] The tire lock at the time of a low friction way or a panic brake is detected in the latest automobile, and many anti-lock brake equipments (ABS) which plan steering stability by loosening a brake and securing a tire grip are adopted as it. Although the rotation sensor was attached in axle bearing and the rotational frequency is detected with this equipment, the electric power supply to the sensor and the output signal of a sensor are communicating with the body section with the electric wire.
[0003]
[Problem(s) to be Solved by the Invention] Between axle bearing and the body, it will expose outside a vehicle and this electric wire tends to cause trouble, such as an open circuit, by the freeze of the snow in stone splashes or a tire house. Moreover, in the case of a steering wheel, it is necessary to give a twist beforehand to an electric wire or, and it needs a great man day for fixation of an electric wire. The covering is also required for the above-mentioned electric wire, and it serves as hindrance of lightweight-izing of an automobile, and since there are many man days of fixation of an electric wire, it is an increase of cost.
[0004] The purpose of this invention is offering the anti-lock brake equipment which there is no fear of an open circuit out of a vehicle, and can aim at lightweight-izing of an automobile, and a cost fall.
[0005]
[Means for Solving the Problem] In the anti-lock brake equipment which this invention detects the rotational speed of a wheel and controls brake damping force by the detecting signal The pulser ring with which the rotation member of a wheel was equipped, and the sensor with which stood face to face against this pulser ring, and wheel supporter material was equipped. It has the control circuit which is installed in the body and controls the above-mentioned damping force, and the wireless means of communication which the

transmitting section and a receive section are respectively installed in the above-mentioned wheel supporter material and the body, and send and receive the signal of the above-mentioned sensor by wireless. Thus, from the transmitting section of wheel supporter material, in order to transmit to the receive section by the side of the body by wireless, the electric wire for sensor signal transduction does not expose the signal of a rotation sensor outside a vehicle between a wheel supporter and the body. Therefore, trouble of an open circuit is not caused by the freeze of the snow in stone splashes or a tire house etc. Moreover, since the electric wire for the sensor signals between a wheel supporter and the body can be excluded and the complicated wiring fixed work also becomes unnecessary, lightweight-izing of an automobile and a cost fall can be aimed at.

[0006] The signal which transmits space should just be used for the above-mentioned wireless means of communication for what performs transmission by light, such as transmission not only by an electric wave but magnetic coupling, and infrared radiation, or transmission by the ultrasonic wave. In magnetic coupling **** transmission, the signal transmission of the above-mentioned wireless means of communication shall be carried out by the magnetic coupling between the transmitting coil prepared in the transmitting section, and the receiver coil prepared in the receive section. A transmitting coil is excited on the frequency of arbitration and makes a receiver coil generate voltage in electromagnetic induction. In transmission by the ultrasonic wave, the signal transmission of the above-mentioned wireless means of communication shall be carried out ultrasonically. In this case, it is made to oscillate by ultrasonic vibrators, such as a piezoelectric device, and the above-mentioned transmitting section modulates and transmits the ultrasonic wave by the signal of a sensor. 20kHz or more exceeding a audio range is used for frequency. In transmission by light, the signal transmission of the above-mentioned wireless means of communication shall be carried out with light. In this case, the above-mentioned transmitting section turns light-emitting devices, such as a laser diode and Light Emitting Diode, to the interior of the tire house of the body, arranges them, and turns and arranges photo detectors, such as a photodiode and a photo transistor, as the above-mentioned receive section into the body at a transmitting section side. In transmission by the electric wave, the signal transmission of the above-mentioned wireless means of communication shall be carried out by the feeble electric wave. Let this feeble electric wave be the electric wave (500micro below of field strength [For example, a 322Mz board 3m distance] V) which does not receive regulation of Wireless Telegraph Law.

[0007] The signal which is transmitted from the transmitting section in the case of the wireless means of communication of each above-mentioned composition (i.e., the case of magnetic coupling, an ultrasonic wave, light, and the wireless means of communication transmitted by any of a feeble electric wave) may be a simple on-off signal, and may modulate a subcarrier by the signal of a sensor. When modulating a subcarrier, the above-mentioned receive section makes it receive [align it and] and restore to the signal transmitted in the above-mentioned transmitting section. The modulation of a subcarrier may turn a subcarrier on and off, and may carry out frequency modulation of the subcarrier. Thus, when modulating

a subcarrier and carrying out the alignment recovery of this, the influence of an external noise can be mitigated.

[0008] In this invention, you may establish a wireless electric supply means to give power required for the transmitting section and the sensor of the above-mentioned wireless means of communication by wireless from a body side. Thus, by establishing a wireless electric supply means, the electric wire for electric supply is not exposed outside a vehicle between a wheel supporter and the body, and the problem of an open circuit of this electric wire for electric supply is also solved. Moreover, unlike the case where a generator is formed, electric power can be supplied also at the time of a body halt, and a zero prompt speed signal can be acquired. A wireless electric supply means is also depended on magnetic coupling, and also, as for transfer of the power by wireless, it can change and transmit power to light, an ultrasonic wave, an electric wave, etc. By the wireless electric supply means, whether it considers as which transfer method by magnetic coupling, light, the ultrasonic wave, the electric wave, etc. is considering as the same method as the transfer method adopted with the wireless means of communication of a sensor signal, and it can attain part communalization of a wireless electric supply means and a wireless means of communication, and communalization of handling.

[0009] this invention -- setting -- the above-mentioned rotation -- the generator generated by rotation of a member is formed and you may make it give the power generation output of the generator to the above-mentioned transmitting section and a sensor Thus, a sensor signal can be transmitted by forming the generator using the turning effort of a wheel, without carrying out an electric power supply separately. Therefore, the wiring for electric power supplies can be excluded.

[0010] moreover, this invention -- setting -- the above-mentioned sensor -- the above-mentioned rotation -- it consists of a generator generated by rotation of a member, this generator is made into the thing of the number which can generate the pulse number which needs the number of magnetic poles for detection of a rotational frequency, and the above-mentioned transmitting section is good also as what transmits power generation frequency as a rotational-speed signal Thus, by using a sensor as a generator, without preparing a rotation sensor separately, the frequency of a generator can be used as a rotation signal as it is, and simplification of composition can be attained.

[0011]

[Embodiments of the Invention] The operation gestalt of this invention is explained based on a drawing. the hub whose wheel 1 is a turning wheel of the axle bearing 2 in drawing 1 -- the wheel supporter material 4 which is attached in a ring 3 and consists of a fixed ring of the axle bearing 2 -- from the body 5 -- caudad -- a protrusion -- it is supported by the suspension (not shown) the bottom In the example of illustration, a wheel 1 is a steering wheel and is connected with the axle 7 through the uniform universal joint 6. rotation of a wheel 1 -- a member 8 -- the composition of a wheel 1 -- the thing of a member which is combined with a member and a wheel 1. and one, and rotates -- it is -- this example -- a hub --

outer-ring-of-spiral-wound-gasket 6a of a ring 3 and the uniform universal joint 6 is included the uniform universal joint 6 -- outer-ring-of-spiral-wound-gasket 6a -- the hub of the axle bearing 2 -- it is really combined with the ring 3 by the fixed state

[0012] A brake 9 brakes a wheel 1 in contact with friction members (not shown), such as a brake drum prepared in the wheel 1, or a brake disc, and is equipped with the oil hydraulic cylinder etc. Energizing of the operation of the brake operating member 10, such as a brake pedal, is changed and carried out to the oil pressure force etc. through the conversion means 11, and it is told to a brake 9. The damping force adjustment means 12 is a means to adjust the damping force of a brake 9, and adjusts damping force according to instructions of a control circuit 13. The damping force adjustment means 12 is formed in the oil pressure path between a brake 9 and the conversion means 11. A control circuit 13 is a means to give adjustment instructions of damping force to the damping force adjustment means 12 according to the wheel rotational frequency detected by the sensor 14 of a rotational frequency, and consists of electronic circuitries, such as a microcomputer.

[0013] A sensor 14 stands face to face against the pulser ring 15 of a wheel 1, is installed in the wheel supporter material 4, detects the pulser ring 15, and outputs a pulse number. the pulser ring 15 -- rotation of a wheel 1 -- it is prepared in the member 8 the example of illustration -- the pulser ring 15 -- outer-ring-of-spiral-wound-gasket 6a of the uniform universal joint 6 -- detailed -- the hub of outer-ring-of-spiral-wound-gasket 6a -- it is prepared in the connection edge with a ring 3 the parts with which the pulser ring 15 makes a sensor 14 generate a pulse output with rotation -- it is -- an outer-diameter side -- a pulse -- things of various kinds of composition according to the sensor 14, such as what prepared the row of teeth (example of drawing 6), a thing (example of drawing 4) in which the magnetic pole opposite to a circumferencial direction by turns arranged, and was prepared, and a thing (not shown) on a par with a circumferencial direction by turns which prepared the grid of a detectable shade optically, are used

[0014] The detecting signal of a sensor 14 is transmitted to a control circuit 13 through a wireless means of communication 16. A wireless means of communication 16 consists of the transmitting section 17 installed in the wheel supporter material 4, and a receive section 18 installed in the body 5. A receive section 18 counters mutually the interior of tire house section 5a in the body 5 with the transmitting section 17, and is prepared in it.

[0015] The signal which transmits space should just be used for a wireless means of communication 16 for what performs transmission by light, such as transmission not only by an electric wave but magnetic coupling, and infrared radiation, or transmission by the ultrasonic wave. In magnetic coupling **** transmission, the signal transmission of the wireless means of communication 16 shall be carried out by the magnetic coupling between the transmitting coil prepared in the transmitting section 17, and the receiver coil prepared in the receive section 18. A transmitting coil is excited on the frequency of arbitration and makes a receiver coil generate voltage in electromagnetic induction. In transmission by the ultrasonic wave, the signal transmission of the wireless means of communication 16 shall be

carried out ultrasonically. In this case, it is made to oscillate by ultrasonic vibrators, such as a piezoelectric device, and the transmitting section 17 modulates and transmits the ultrasonic wave by the signal of a sensor. 20kHz or more exceeding a audio range is used for frequency. In transmission by light, the signal transmission of the wireless means of communication 16 shall be carried out with light, such as infrared radiation and a visible ray. In this case, the transmitting section 17 turns light emitting devices, such as a laser diode and Light Emitting Diode, to the interior of tire house 5a of the body 5, arranges them, and turns and arranges photo detectors, such as a photodiode and a photo transistor, as a receive section 18 into the body 5 at the transmitting section 17 side. In transmission by the electric wave, the signal transmission of the wireless means of communication 16 shall be carried out by the feeble electric wave. Let this feeble electric wave be the electric wave (500micro below of field strength [For example, a 322Mz board 3m distance] V) which does not receive regulation of Wireless Telegraph Law. In this case, a signal is transmitted by turning on and off and frequency modulation of an electric wave.

[0016] The signal which is transmitted from the transmitting section 17 in the case of the wireless means of communication 16 of each above-mentioned composition (i.e., the case of magnetic coupling, an ultrasonic wave, light, and the wireless means of communication 16 transmitted by any of a feeble electric wave) may be a simple on-off signal, and may modulate a subcarrier by the signal of a sensor 14. When modulating a subcarrier, a receive section 18 makes it receive [align it and] and restore to the signal transmitted in the transmitting section 17. The modulation of a subcarrier may turn a subcarrier on and off, and may carry out frequency modulation of the subcarrier. Thus, when modulating a subcarrier and carrying out the alignment recovery of this, the influence of an external noise can be mitigated.

[0017] Drawing 2 shows the example of the wireless means of communication 16 made into magnetic coupling. The transmitting section 17 consists of an oscillation, a modulation circuit 19, and a transmitting coil 20. The transmitting coil 20 has a magnetic core. An oscillation and a modulation circuit 19 consist of an oscillator circuit which oscillates the subcarrier of predetermined frequency (for example, 1MHz), and a modulation circuit which modulates the oscillated subcarrier with the output of a sensor 14. Electric supply to a sensor 14, and an oscillation and a modulation circuit 19 is performed from the transmitting section power supply 23. A receive section 18 consists of a receiver coil 22 by which magnetic coupling was carried out to the transmitting coil 20, and an alignment demodulator circuit 21 which aligns and restores to an input signal. A receiver coil 22 has a magnetic core. Distance L of the transmitting coil 20 and a receiver coil 22 is set to about 40cm.

[0018] Although the modulation techniques of an oscillation and a modulation circuit 19 may be arbitrary methods, they turn the output of the oscillator circuit section on and off using the output of a sensor 14, and are controlling the current which flows in the transmitting coil 20 here. It comes to indicate it in drawing 3 as the voltage (sending signal) concerning the transmitting coil 20, and the input signal obtained from a receiver coil 22 by the alignment demodulator circuit 21. If AM recovery of the input signal is carried out, the pulse output of

the sensor 14 which is a rotation sensor will be obtained.

[0019] Let the transmitting section power supply 23 be a generator using rotation of a wheel, or the below-mentioned wireless electric supply means. When considering as the generator using rotation of a wheel, the signal of a sensor 14 can be transmitted without carrying out an electric power supply separately. this generator -- the hub of a wheel 1 -- it builds near the section This generator is good also as a thing only for power supplies, and good also as what makes a sensor serve a double purpose.

[0020] When considering as a generator, the pulser ring 15 shown in drawing 1 is set to ring magnet 15for power generation A as shown in drawing 4 , and a sensor 14 is set to generator coil 14A. Generator 23A consists of ring magnet 15A for these power generation, and a sensor 14. When ring magnet 15A rotates with a wheel 1, alternating field are made to generator coil 14A, and this coil 14A is made to generate an induced voltage. By rectifying this generated alternating voltage, it considers as the power supply of the transmitting section 17 (drawing 1) and a sensor 14. This generator 23A is good also as what serves as a rotation sensor also as only for power supplies. When carrying out to power supplies only, as shown in drawing 7 , the pulser ring 15 and the sensor 14 for rotation detection corresponding to this are formed separately, and the output of generator 23A is used as a power supply of the transmitting section 17 and a sensor 14.

[0021] Generator 23A explained with drawing 4 can use the frequency of generator 23A as a rotational frequency detecting signal as it is, without preparing a rotation sensor separately by making the number of magnetic poles into a pulse number required as a rotation sensor of anti-lock brake equipment. Drawing 4 (B) shows the state where ring magnet 15A for power generation rotated only angle of rotation for one pole from the state of drawing 4 (A). In drawing 4 , the sign of N and S shows a magnetic pole and Arrow a shows the direction of a magnetic field respectively. Since this generator 23A can generate the alternating voltage of the frequency which multiplied by the number of pole pairs of this ring magnet 15A in the rotational frequency of ring magnet 15A, it uses voltage after rectification as the power supply of the transmitting section 17, and can use the number of ac cycles for it as a rotational frequency detection value.

[0022] The example of a circuit of the transmitting section 17 in the case of making the sensor of a rotational frequency serve a double purpose by generator 23A is shown in drawing 5 . In this circuit, while power of AC-generator 23A which synchronized with the wheel rotational frequency is direct-current-ized by the rectifier circuit 25 and serves as the power supply Vdd of oscillator circuit 19a, modulation circuit 19b, and the transmitting coil 20, the transistor 27 for output turning on and off which constitutes modulation circuit 19b is driven, and the output modulation which synchronized with the rotational frequency is performed. At the time of a rotation fall, the power accumulated at the mass capacitor or rechargeable battery 26 of a rectifier circuit 25 at the time of a run is using as circuit drive power, and makes detection possible to the low speed field at the time of a slowdown. Oscillator circuit 19a and modulation circuit 19b constitute an oscillation and the modulation circuit 19 of drawing 2 .

[0023] Below. the example which makes the transmitting section power supply 23 of drawing 2 a wireless electric supply means is explained with drawing 8 . That is. wireless electric supply means 23B which gives power required for the transmitting section 17 and the sensor 14 of a wireless means of communication 16 by wireless from a body 5 side is prepared. This wireless electric supply means 23B counters mutually the body 5 and the wheel supporter material 4. and prepares in them the transmitting section 31 and the receive section 32 which send and receive the power of the power supply 30 installed in the body 5 by wireless. Thus. by preparing wireless electric supply means 23B, the electric wire for electric supply is not exposed outside a vehicle between the wheel supporter 4 and the body 5, and the problem of an open circuit of this electric wire for electric supply is also solved. Moreover, unlike the case where a generator is formed. electric power can be supplied also at the time of a body halt, and a zero prompt speed signal can be acquired.

[0024] Wireless electric supply means 23B is also depended on magnetic coupling, and also it transforms power into light. an ultrasonic wave, an electric wave, etc.. and can perform transfer of the power by wireless. By wireless electric supply means 23B, whether it considers as which transfer method by magnetic coupling, light, the ultrasonic wave. the electric wave, etc. is considering as the same method as the transfer method adopted with the wireless means of communication 16 of a sensor signal, and it can attain part communalization of wireless electric supply means 23B and a wireless means of communication 16, and communalization of handling.

[0025] When considering wireless electric supply means 23B as transmission by magnetic coupling, a receiver coil is made to generate voltage in electromagnetic induction by arranging a transmitting coil as the transmitting section 31, arranging a receiver coil as a receive section 32 into the body 5, at the wheel supporter material 4, and exciting the transmitting coil by the side of the body on arbitrary frequency. When the magnetic coupling force is weak and required power is not obtained at this time, the magnetic coupling force can also be raised by using the body mechanism section which combines the body 5 and the wheel supporter material 4, such as a link bar and a shock absorber, as a magnetic core. Moreover, the coil for transmission and the coil for reception can also share the same coil by power and the signal by dividing the frequency the object for power, and for signals.

[0026] When considering wireless electric supply means 23B as transmission by light, into the body 5, as the transmitting section 31, light emitting devices, such as a laser diode and Light Emitting Diode, are turned to the wheel supporter material 4, and are arranged, and to the wheel supporter material 4, the elements (solar battery etc.) which have the photovoltaic effect as a receive section 32 are turned to the transmitting section 31, and are arranged. Thereby, power can be transmitted to the wheel supporter material 4 with light from the body 5.

[0027] When considering wireless electric supply means 23B as transmission by the ultrasonic wave, in response to an ultrasonic wave, it changes into power by the receive section 32, using a ultrasonic vibrator as the transmitting section 31. In addition, when based

on an ultrasonic wave, unlike the case where it is based on magnetic coupling. the above-mentioned body mechanism section cannot be used for transfer.

[0028] When considering wireless electric supply means 23B as transmission by the electric wave, since it is not behind in power by the feeble electric wave unlike a signal, microwave (3GHz - about 5GHz) is used. A microwave transmitter is installed in the body 5 as the transmitting section 31, and a receiving antenna and a rectifier are formed in the wheel supporter material 4 as a receive section 32. This performs a transfer of power. Since directivity is high, microwave is still more efficient when it is made for the transmitting section 31 and a receive section 32 to always face each other using a link bar etc.

[0029]

[Effect of the Invention] The signal of a rotation sensor is written as what is sent and received from the transmitting section of wheel supporter material by wireless to the receive section by the side of the body, and, as for the anti-lock brake equipment of this invention, an electric wire does not expose it outside a vehicle between a wheel supporter and the body. Therefore, trouble of an open circuit is not caused by the freeze of the snow in stone splashes or a tire house etc. Moreover, since the electric wire for the sensor signals between a wheel supporter and the body can be excluded and the complicated wiring fixed work also becomes unnecessary, lightweight-izing of an automobile and a cost fall can be aimed at.

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号
特開2001－151090
（P2001－151090A）
(43)公開日　平成13年６月５日(2001.6.5)

(51)Int.Cl.'	識別記号	ＦＩ		テーマコード（参考）
Ｂ６０Ｔ　8/00		Ｂ６０Ｔ　8/00	Ａ	２Ｆ０７３
8/34		8/34		３Ｄ０４６
Ｇ０８Ｃ　17/02		Ｇ０８Ｃ　19/00	Ｃ	
19/00		Ｇ０１Ｐ　3/487	Ｆ	
23/02			Ｚ	

審査請求　未請求　請求項の数10　ＯＬ　（全７頁）　最終頁に続く

(21)出願番号　特願平11－339588

(22)出願日　平成11年11月30日(1999.11.30)

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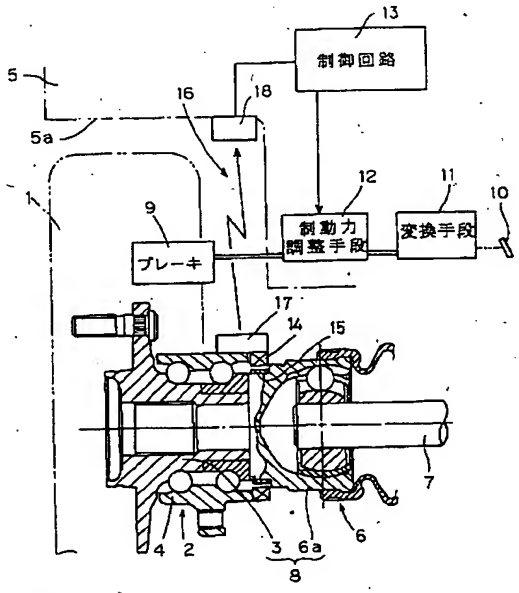
Ｆターム(参考)　2F073 AA35 AB07 BB02 BC02 BC04
BC05 BC10 CC01 CD04 CD13
EE12 FF03 FF08 GG02 GG05
3D046 BB00 BB12 BB28 HH36

(54)【発明の名称】　アンチロックブレーキ装置

(57)【要約】
【課題】　車外での断線の恐れがなく、また自動車の軽量化、コスト低下が図れるアンチロックブレーキ装置を提供する。
【解決手段】　車体５に、車輪回転速度の検出信号によりブレーキ９の制動力の制御を行う制御回路１３を設ける。車輪１の回転部材８にパルサリング１５を装着し、これに対峙して車輪支持部材４に回転検出用のセンサ１４を設ける。このセンサ１４の出力をワイヤレス伝達手段１６で伝達する。ワイヤレス伝達手段１６は、車輪支持部材４に設置された送信部１７と、車体５に設置された受信部１８とでなる。ワイヤレス伝達手段１６は、電波に限らず、磁気結合による伝送、赤外線等の光による伝送、または超音波による伝送を行うものであっても良い。



1:車輪　6:等速自在継手　15:パルサリング
2:車軸軸受　8:回転部材　16:ワイヤレス伝達手段
3:ハブ輪　9:ブレーキ　17:送信部
4:車輪支持部材　13:制御回路　18:受信部
5:車体　14:センサ

【特許請求の範囲】
【請求項１】 車輪の回転速度を検出し、その検出信号によりブレーキ制動力の制御を行うアンチロックブレーキ装置において、車輪の回転部材に装着されたパルサリングと、このパルサリングに対峙して車輪支持部材に装着されたセンサと、車体に設置されて上記制動力の制御を行う制御回路と、上記車輪支持部材および車体に送信部および受信部が各々設置され上記センサの信号をワイヤレスで送受するワイヤレス伝達手段とを備えたアンチロックブレーキ装置。
【請求項２】 上記ワイヤレス伝達手段は、送信部に設けられた送信コイルと受信部に設けられた受信コイルとの間の磁気結合で信号伝送するものとした請求項１に記載のアンチロックブレーキ装置。
【請求項３】 上記ワイヤレス伝達手段を、超音波で信号伝送するものとした請求項１に記載のアンチロックブレーキ装置。
【請求項４】 上記ワイヤレス伝達手段は、光で信号伝送するものとした請求項１に記載のアンチロックブレーキ装置。
【請求項５】 上記ワイヤレス伝達手段は、微弱電波で信号伝送するものとした請求項１に記載のアンチロックブレーキ装置。
【請求項６】 上記送信部で送信する信号は、搬送波をセンサの信号で変調したものとし、上記受信部は上記送信部で送信された信号を同調して受信し復調させるものとした請求項１ないし請求項５のいずれかに記載のアンチロックブレーキ装置。
【請求項７】 上記送信部で行う搬送波の変調は、周波数変調とした請求項６に記載のアンチロックブレーキ装置。
【請求項８】 上記ワイヤレス伝達手段の上記送信部およびセンサに必要な電力を、車体側からワイヤレスで与えるワイヤレス給電手段を設けた請求項１ないし請求項７のいずれかに記載のアンチロックブレーキ装置。
【請求項９】 上記回転部材の回転で発電する発電機を設け、その発電機の発電出力を上記送信部およびセンサに与えるようにした請求項１に記載のアンチロックブレーキ装置。
【請求項１０】 上記センサは、上記回転部材の回転で発電する発電機からなり、この発電機は、磁極数が回転数の検出に必要なパルス数を発生可能な数のものとし、上記送信部は、発電周波数を回転速度信号として送信するものとした請求項１に記載のアンチロックブレーキ装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】この発明は、自動車におけるアンチロックブレーキ装置に関する。
【０００２】
【従来の技術】最近の自動車には、低摩擦路やパニックブレーキ時のタイヤロックを検知し、ブレーキを緩めてタイヤグリップを確保することで操舵安定性を図るアンチロックブレーキ装置（ＡＢＳ）が多く採用されている。この装置では、車軸軸受部に回転センサを取付け、回転数を検出しているが、そのセンサへの電力供給やセンサの出力信号は、電線で車体部とやりとりしている。
【０００３】
【発明が解決しようとする課題】この電線は、車軸軸受部と車体との間では車外に露出することになり、石跳ねやタイヤハウス内の雪の凍結により断線等の支障を起こし易い。また、操舵輪の場合は、電線に予め捩じれを与えておく必要があったり、電線の固定に多大な工数が必要であったりする。上記の電線はその被覆も必要で、自動車の軽量化の妨げとなり、また電線の固定の工数が多いことから、コスト増となっている。
【０００４】この発明の目的は、車外での断線の恐れがなく、また自動車の軽量化、コスト低下が図れるアンチロックブレーキ装置を提供することである。
【０００５】
【課題を解決するための手段】この発明は、車輪の回転速度を検出し、その検出信号によりブレーキ制動力の制御を行うアンチロックブレーキ装置において、車輪の回転部材に装着されたパルサリングと、このパルサリングに対峙して車輪支持部材に装着されたセンサと、車体に設置されて上記制動力の制御を行う制御回路と、上記車輪支持部材および車体に送信部および受信部が各々設置され上記センサの信号をワイヤレスで送受するワイヤレス伝達手段とを備えたものである。このように、回転センサの信号を、車輪支持部材の送信部から、車体側の受信部にワイヤレスで送信するため、車輪支持部と車体との間でセンサ信号伝達用の電線が車外に露出しない。そのため、石跳ねやタイヤハウス内の雪の凍結等により、断線の支障を起こすことがない。また、車輪支持部と車体との間のセンサ信号用の電線が省け、その煩雑な配線固定作業も不要となるため、自動車の軽量化、コスト低下が図れる。
【０００６】上記ワイヤレス伝達手段は、電波に限らず、磁気結合による伝送、赤外線等の光による伝送、または超音波による伝送を行うものなど、空間を伝送する信号を用いるものであれば良い。磁気結合よる伝送の場合、上記ワイヤレス伝達手段は、送信部に設けられた送信コイルと受信部に設けられた受信コイルとの間の磁気結合で信号伝送するものとする。送信コイルは、例えば任意の周波数で励磁し、電磁誘導で受信コイルに電圧を発生させる。超音波による伝送の場合、上記ワイヤレス伝達手段は、超音波で信号伝送するものとする。この場合、例えば、上記送信部は、圧電素子等の超音波振動子で発振させ、その超音波をセンサの信号で変調して伝送する。周波数は、可聴域を超える２０ｋＨｚ以上を用い

る。光による伝送の場合、上記ワイヤレス伝達手段は、光で信号伝送するものとする。この場合、例えば上記送信部は、レーザダイオードやＬＥＤ等の発光素子を車体のタイヤハウス内部に向けて配置し、車体には上記受信部として、フォトダイオードやフォトトランジスタ等の受光素子を送信部側に向けて配置する。電波による伝送の場合、上記ワイヤレス伝達手段は、微弱電波で信号伝送するものとする。この微弱電波は、電波法の規制を受けない電波（例えば、３２２Ｍｚ板では３ｍの距離で電界強度５００μＶ以下）とする。

【０００７】上記の各構成のワイヤレス伝達手段の場合に、つまり磁気結合、超音波、光、微弱電波のいずれで送信するワイヤレス伝達手段の場合にも、送信部から送信する信号は、単純なオンオフ信号であっても良く、また搬送波をセンサの信号で変調したものであっても良い。搬送波を変調する場合、上記受信部は上記送信部で送信された信号を同調して受信し、復調させるものとする。搬送波の変調は、搬送波をオンオフするものであっても良く、また搬送波を周波数変調するものであっても良い。このように搬送波を変調し、これを同調復調する場合、外部ノイズの影響を軽減できる。

【０００８】この発明において、上記ワイヤレス伝達手段の送信部およびセンサに必要な電力を、車体側からワイヤレスで与えるワイヤレス給電手段を設けても良い。このようにワイヤレス給電手段を設けることで、車輪支持部と車体との間で給電用の電線が車外に露出せず、この給電用電線の断線の問題も解消される。また発電機を設ける場合と異なり、車体停止時にも給電が可能で、零速から速度信号を得ることができる。ワイヤレス給電手段も、ワイヤレスによる電力の伝達は、磁気結合によるほかに、光、超音波、電波等に電力を変換して伝達することができる。ワイヤレス給電手段により、磁気結合、光、超音波、電波等によるいずれの伝達方式とするかは、センサ信号のワイヤレス伝達手段で採用する伝達方式と同じ方式とすることで、ワイヤレス給電手段およびワイヤレス伝達手段の部品共通化や取扱の共通化が図れる。

【０００９】この発明において、上記回転部材の回転で発電する発電機を設け、その発電機の発電出力を上記送信部およびセンサに与えるようにしても良い。このように車輪の回転力を利用した発電機を設けることで、別途に電力供給することなく、センサ信号を伝送することができる。そのため、電力供給用の配線が省ける。

【００１０】また、この発明において、上記センサは、上記回転部材の回転で発電する発電機からなり、この発電機は、磁極数が回転数の検出に必要なパルス数を発生可能な数のものとし、上記送信部は、発電周波数を回転速度信号として送信するものとしても良い。このように、センサを発電機とすることで、別途に回転センサを用意することなく、発電機の周波数をそのまま回転信号として利用することができ、構成の簡易化が図れる。

【００１１】

【発明の実施の形態】この発明の実施形態を図面に基づいて説明する。図１において、車輪１は車軸軸受２の回転輪であるハブ輪３に取付けられ、車軸軸受２の固定輪からなる車輪支持部材４は、車体５から下方に突出したサスペンション（図示せず）に支持されている。車輪１は、図示の例では操舵輪であり、等速自在継手６を介して車軸７に連結されている。車輪１の回転部材８は、車輪１の構成部材および車輪１と一体に結合されて回転する部材のことであり、この例ではハブ輪３および等速自在継手６の外輪６ａを含む。等速自在継手６は、外輪６ａが車軸軸受２のハブ輪３に一体固定状態に結合されている。

【００１２】ブレーキ９は、車輪１に設けられたブレーキドラムまたはブレーキディスク等の摩擦部材（図示せず）に接して車輪１を制動するものであり、油圧シリンダ等を備えている。ブレーキペタル等のブレーキ操作部材１０の操作は、変換手段１１を介して油圧力等に変換され、増力してブレーキ９に伝えられる。制動力調整手段１２は、ブレーキ９の制動力を調整する手段であり、制御回路１３の指令に応じて制動力を調整する。制動力調整手段１２は、ブレーキ９と変換手段１１との間の油圧経路に設けられている。制御回路１３は、回転数のセンサ１４で検出された車輪回転数に応じて制動力調整手段１２に制動力の調整指令を与える手段であり、マイクロコンピュータ等の電子回路で構成されている。

【００１３】センサ１４は、車輪１のパルサリング１５に対峙して車輪支持部材４に設置され、パルサリング１５を検出してパルス数を出力するものである。パルサリング１５は、車輪１の回転部材８に設けられている。図示の例では、パルサリング１５は、等速自在継手６の外輪６ａに、詳しくは外輪６ａのハブ輪３との連結端に設けられている。パルサリング１５は、回転に伴ってセンサ１４にパルス出力を発生させる部品であり、外径面にパルス歯列を設けたもの（図６の例）や、円周方向に交互に反対の磁極が並べて設けられたもの（図４の例）や、円周方向に交互に並ぶ光学的に検出可能な濃淡の格子を設けたもの（図示せず）など、センサ１４に応じた各種の構成のものが使用される。

【００１４】センサ１４の検出信号は、ワイヤレス伝達手段１６を介して制御回路１３に伝送される。ワイヤレス伝達手段１６は、車輪支持部材４に設置された送信部１７と、車体５に設置された受信部１８とで構成される。受信部１８は、例えば車体５におけるタイヤハウス部５ａの内部に、送信部１７と互いに対向して設けられる。

【００１５】ワイヤレス伝達手段１６は、電波に限らず、磁気結合による伝送、赤外線等の光による伝送、または超音波による伝送を行うものなど、空間を伝送する

信号を用いるものであれば良い。磁気結合よる伝送の場合、ワイヤレス伝達手段１６は、送信部１７に設けられた送信コイルと受信部１８に設けられた受信コイルとの間の磁気結合で信号伝送するものとする。送信コイルは、例えば任意の周波数で励磁し、電磁誘導で受信コイルに電圧を発生させる。超音波による伝送の場合、ワイヤレス伝達手段１６は、超音波で信号伝送するものとする。この場合、例えば、送信部１７は、圧電素子等の超音波振動子で発振させ、その超音波をセンサの信号で変調して伝送する。周波数は、可聴域を超える２０ｋＨｚ以上を用いる。光による伝送の場合、ワイヤレス伝達手段１６は、赤外線や可視光線等の光で信号伝送するものとする。この場合、送信部１７は、レーザダイオードやＬＥＤ等の発光素子を車体５のタイヤハウス５ａの内部に向けて配置し、車体５には受信部１８として、フォトダイオードやフォトトランジスタ等の受光素子を送信部１７側に向けて配置する。電波による伝送の場合、ワイヤレス伝達手段１６は、微弱電波で信号伝送するものとする。この微弱電波は、電波法の規制を受けない電波（例えば、３２２Ｍｚ板では３ｍの距離で電界強度５００μＶ以下）とする。この場合、電波のオンオフや周波数変調で信号を伝達する。

【００１６】上記の各構成のワイヤレス伝達手段１６の場合に、つまり磁気結合、超音波、光、微弱電波のいずれで送信するワイヤレス伝達手段１６の場合にも、送信部１７から送信する信号は、単純なオンオフ信号であっても良く、また搬送波をセンサ１４の信号で変調したものであっても良い。搬送波を変調する場合、受信部１８は送信部１７で送信された信号を同調して受信し、復調させるものとする。搬送波の変調は、搬送波をオンオフするものであっても良く、また搬送波を周波数変調するものであっても良い。このように搬送波を変調し、これを同調復調する場合、外部ノイズの影響を軽減できる。

【００１７】図２は、磁気結合としたワイヤレス伝達手段１６の具体例を示す。送信部１７は、発振・変調回路１９および送信コイル２０で構成される。送信コイル２０は磁気コアを有するものである。発振・変調回路１９は、所定周波数（例えば１ＭＨｚ）の搬送波を発振する発振回路、およびその発振された搬送波をセンサ１４の出力で変調する変調回路で構成される。センサ１４および発振・変調回路１９への給電は、送信部電源２３から行われる。受信部１８は、送信コイル２０に磁気結合された受信コイル２２と、受信信号を同調して復調する同調復調回路２１とで構成される。受信コイル２２は磁気コアを有するものである。送信コイル２０と受信コイル２２の距離Ｌは、例えば４０cm程度とされる。

【００１８】発振・変調回路１９の変調方式は、任意の方式であっても良いが、ここではセンサ１４の出力を利用して発振回路部の出力をオンオフし、送信コイル２０に流れる電流を制御している。送信コイル２０にかかる電圧（送信信号）と、受信コイル２２から同調復調回路２１に得られる受信信号とは、例えば図３に示すようになる。受信信号をＡＭ復調すると、回転センサであるセンサ１４のパルス出力が得られる。

【００１９】送信部電源２３は、車輪の回転を利用した発電機、または後述のワイヤレス給電手段とされる。車輪の回転を利用した発電機とする場合、別途に電力供給することなくセンサ１４の信号を伝送することができる。この発電機は、車輪１のハブ部付近に内蔵する。この発電機は、電源専用のものとしても良く、またセンサを兼用するものとしても良い。

【００２０】発電機とする場合、例えば、図１に示すパルサリング１５を、図４に示すように発電用リング磁石１５Ａとし、センサ１４を発電機コイル１４Ａとする。これら発電用リング磁石１５Ａとセンサ１４とで発電機２３Ａが構成される。リング磁石１５Ａが車輪１と共に回転すると、発電機コイル１４Ａに交番磁界を作り、このコイル１４Ａに誘起電圧を発生させる。この発生した交流電圧を整流することで、送信部１７（図１）およびセンサ１４の電源とする。この発電機２３Ａは、電源専用としても、回転センサを兼ねるものとしても良い。電源専用とする場合は、図７に示すように、別途にパルサリング１５とこれに対応する回転検出用のセンサ１４とを設け、発電機２３Ａの出力を送信部１７およびセンサ１４の電源として用いる。

【００２１】図４と共に説明した発電機２３Ａは、磁極数をアンチロックブレーキ装置の回転センサとして必要なパルス数にすることにより、別途に回転センサを用意することなく、発電機２３Ａの周波数をそのまま回転数検出信号として利用することができる。図４（Ｂ）は、図４（Ａ）の状態から発電用リング磁石１５Ａが１極分の回転角度だけ回転した状態を示す。図４において、Ｎ，Ｓの符号は磁極を、矢印ａは磁界の方向を各々示す。この発電機２３Ａは、リング磁石１５Ａの回転数に、このリング磁石１５Ａの極対数を乗じた周波数の交流電圧を発生することができるため、整流後の電圧を送信部１７の電源とし、交流周波数を回転数検出値として利用できる。

【００２２】発電機２３Ａで回転数のセンサを兼用する場合の送信部１７の回路例を図５に示す。この回路では、車輪回転数に同期した交流発電機２３Ａの電力が、整流回路２５で直流化され、発振回路１９ａ、変調回路１９ｂ、および送信コイル２０の電源Ｖｄｄとなると共に、変調回路１９ｂを構成する出力オンオフ用のトランジスタ２７を駆動し、回転数に同期した出力変調を行う。走行時に整流回路２５の大容量コンデンサまたは二次電池２６に蓄積された電力は、回転低下時に回路駆動電力として用いることで、減速時の低速度領域まで検出を可能とする。発振回路１９ａおよび変調回路１９ｂは、図２の発振・変調回路１９を構成するものである。

【００２３】つぎに、図２の送信部電源２３をワイヤレス給電手段とする例を、図８と共に説明する。すなわち、ワイヤレス伝達手段１６の送信部１７およびセンサ１４に必要な電力を、車体５側からワイヤレスで与えるワイヤレス給電手段２３Ｂを設ける。このワイヤレス給電手段２３Ｂは、車体５に設置された電源３０の電力をワイヤレスで送受する送信部３１および受信部３２を、車体５および車輪支持部材４に互いに対向して設けたものである。このようにワイヤレス給電手段２３Ｂを設けることで、車輪支持部４と車体５との間で給電用の電線が車外に露出せず、この給電用電線の断線の問題も解消される。また、発電機を設ける場合と異なり、車体停止時にも給電が可能で、零速から速度信号を得ることができる。

【００２４】ワイヤレス給電手段２３Ｂも、ワイヤレスによる電力の伝達は、磁気結合によるほかに、光、超音波、電波等に電力を変換して行える。ワイヤレス給電手段２３Ｂにより、磁気結合、光、超音波、電波等によるいずれの伝達方式とするかは、センサ信号のワイヤレス伝達手段１６で採用する伝達方式と同じ方式とすることで、ワイヤレス給電手段２３Ｂおよびワイヤレス伝達手段１６の部品共通化や取扱の共通化が図れる。

【００２５】ワイヤレス給電手段２３Ｂを磁気結合による伝送とする場合、車体５に送信部３１として送信コイルを、車輪支持部材４に受信部３２として受信コイルを配置し、車体側の送信コイルを任意の周波数で励磁することにより、電磁誘導で受信コイルに電圧を発生させる。この時、磁気結合力が弱くて必要電力が得られない場合は、リンクバーやショックアブソーバー等の車体５と車輪支持部材４を結合する車体機構部を磁気コアとして用いることで磁気結合力を向上させることもできる。また、電力用と信号用の周波数を分けることで、送信用コイルおよび受信用コイルとも、同じコイルを電力と信号で共用することもできる。

【００２６】ワイヤレス給電手段２３Ｂを光による伝送とする場合、車体５に送信部３１としてレーザダイオードやＬＥＤ等の発光素子を車輪支持部材４に向けて配置し、車輪支持部材４には受信部３２として光起電効果のある素子（太陽電池等）を送信部３１に向けて配置する。これにより、車体５より車輪支持部材４に光で電力を伝達することができる。

【００２７】ワイヤレス給電手段２３Ｂを超音波による伝送とする場合は、送信部３１として超音波振動子を用い、超音波を受信部３２で受けて電力に変換する。なお、超音波による場合は、磁気結合による場合と異なり、上記車体機構部を伝達に利用できない。

【００２８】ワイヤレス給電手段２３Ｂを電波による伝送とする場合は、信号と異なり、微弱電波では電力を遅れないので、マイクロウェーブ（３ＧＨｚ～５ＧＨｚ程度）を用いる。車体５に送信部３１としてマイクロウェーブ送信機を設置し、車輪支持部材４に受信部３２として受信アンテナと整流器を設ける。これにより、電力伝送を行う。マイクロウェーブは指向性が高いので、リンクバー等を利用して常に送信部３１と受信部３２とが向き合うようにすると、さらに効率が良い。

【００２９】

【発明の効果】この発明のアンチロックブレーキ装置は、回転センサの信号を、車輪支持部材の送信部から、車体側の受信部にワイヤレスで送受するものとしたため、車輪支持部と車体との間で電線が車外に露出しない。そのため、石跳ねやタイヤハウス内の雪の凍結等により、断線の支障を起こすことがない。また、車輪支持部と車体との間のセンサ信号用の電線が省け、その煩雑な配線固定作業も不要となるため、自動車の軽量化、コスト低下が図れる。

【図面の簡単な説明】

【図１】この発明の一実施形態にかかるアンチロックブレーキ装置の概念構成を示す説明図である。

【図２】そのワイヤレス伝達手段の概念構成例を示すブロック図である。

【図３】同ワイヤレス伝達手段で送受する信号の波形図である。

【図４】（Ａ），（Ｂ）は各々同アンチロックブレーキ装置における発電機の互いに異なる動作状態の切欠斜視図である。

【図５】同発電機を回転センサに兼用する送信部の電気回路図である。

【図６】パルサリングおよびセンサの変形例の説明図である。

【図７】この発明の他の実施形態にかかるアンチロックブレーキ装置の一部省略断面図とブロック図とを合わせて示す説明図である。

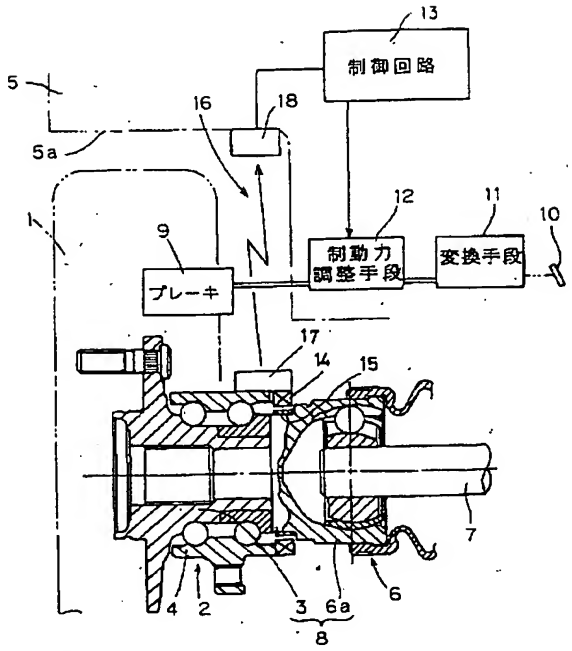
【図８】この発明のさらに他の実施形態にかかるアンチロックブレーキ装置の概念構成を示す説明図である。

【符号の説明】

１…車輪
２…車軸軸受
３…ハブ輪
４…車輪支持部材
５…車体
６…等速自在継手
８…回転部材
９…ブレーキ
１３…制御回路
１４…センサ
１４Ａ…発電機コイル
１５…パルサリング
１５Ａ…発電用リング磁石
１６…ワイヤレス伝達手段
１７…送信部

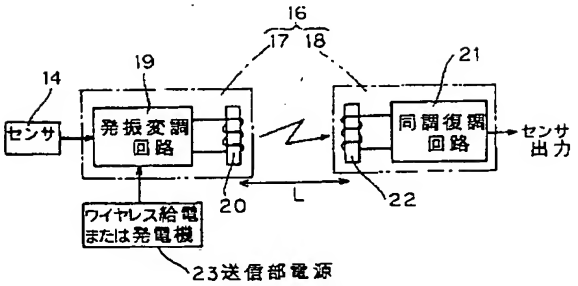
１８…受信部
２３…送信部電源
２３Ａ…発電機
２３Ｂ…ワイヤレス給電手段

【図１】

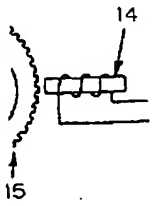


1:車輪　6:等速自在継手　15:パルサリング
2:車軸軸受　8:回転部材　16:ワイヤレス伝達手段
3:ハブ輪　9:ブレーキ　17:送信部
4:車軸支持部材　13:制御回路　18:受信部
5:車体　14:センサ

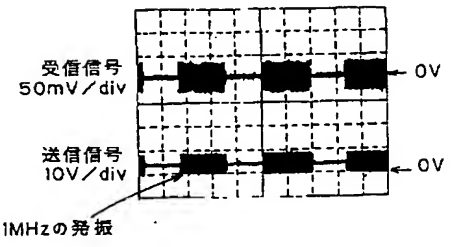
【図２】



【図６】



【図３】



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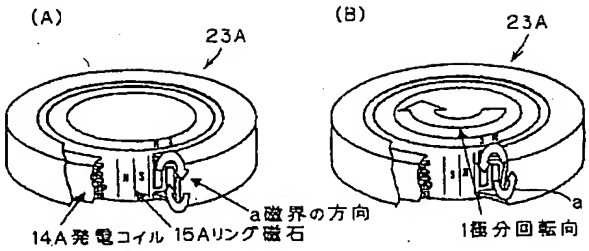

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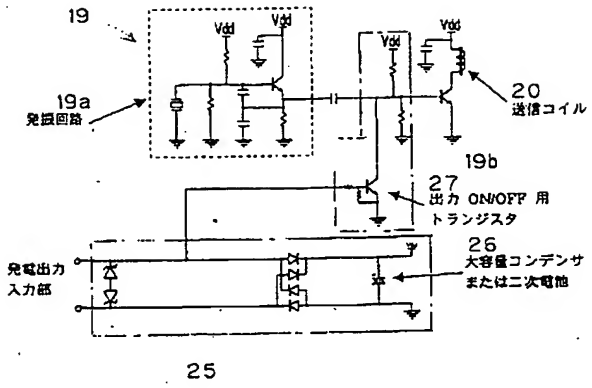

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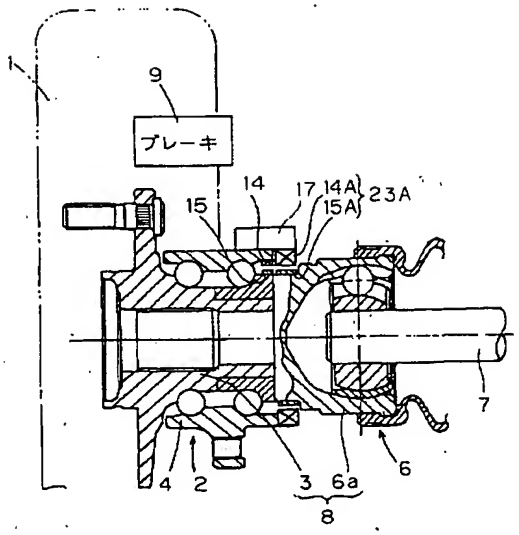
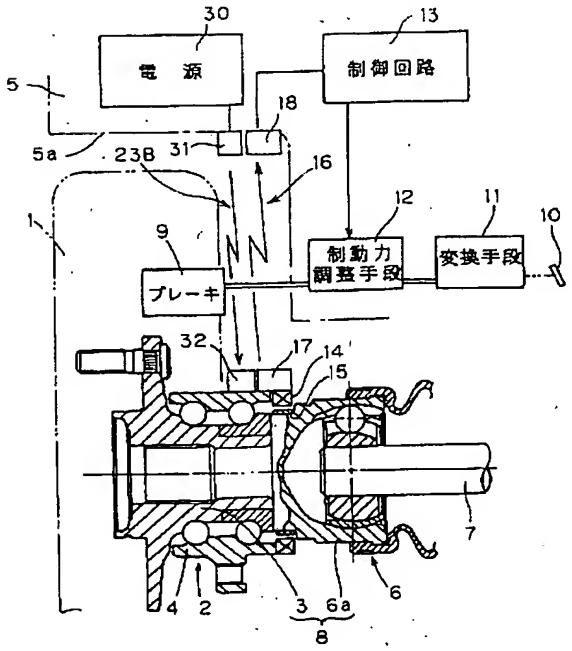


【図８】



フロントページの続き

(51) Int. Cl.[7]	識別記号	F I		テーマコード（参考）
G08C	23/04	G01P	3/488	F
// G01P	3/487			Z
		G08C	17/00	B
	3/488		23/00	C
				B

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 08-029441
(43)Date of publication of application : 02.02.1996

(51)Int.CI. G01P 3/488
B60T 8/00

(21)Application number : 06-165404
(22)Date of filing : 18.07.1994

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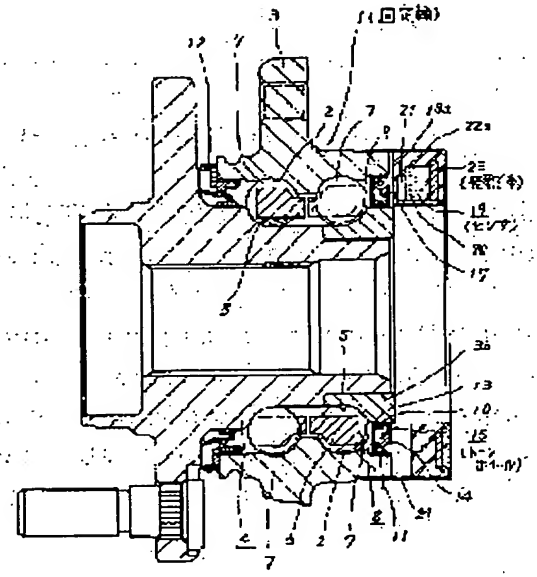
(72)Inventor : MORITA KOICHI

(54) ROTATING SPEED DETECTING DEVICE

(57)Abstract:

PURPOSE: To prevent the change of the distance between a sensor and a tone wheel or the breakage of a constituting component due to the freeze of water that has intruded into the inside.

CONSTITUTION: In a synthetic resin case 22a in which a sensor 19 has been enclosedly embedded, a heating element 22 other than the sensor 19 is provided. When the freezing of water is possible, the heating element 23 is electrically energized. Water intruded inside a cover 18a is discharged through a draining hole 24 formed in the lowest position of the cover 18a.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] the hub for the rotational-speed detection equipment concerning this invention supporting the wheel of an automobile -- it includes in a unit, and it uses in order to detect the rotational speed of this wheel
[0002]
[Description of the Prior Art] In order to control the anti-lock brake system (ABS) of an automobile, or a traction control system (TCS), it is necessary to detect the rotational speed of a wheel. The rolling bearing unit incorporating the rotational-speed detection equipment for it is proposed from the former as indicated by JP,3-128856,U, the 5-4021 official report, or the U.S. Pat. No. 5063345 specification. Drawing 5 -7 show one example of the structure of such a rolling bearing unit with rotational-speed detection equipment.
[0003] The outer-ring-of-spiral-wound-gasket orbits 2 and 2 of a double row are formed in the inner skin of the fixed ring 1 which does not rotate at the time of use. This fixed ring 1 is supported by the flange 3 formed in the periphery side at a suspension system. Inside this fixed ring 1, the turning wheel 4 which rotates with a wheel at the time of use is arranged. The inner-ring-of-spiral-wound-gasket orbits 5 and 5 are formed in the periphery side of this turning wheel 4, and these inner-rings-of-spiral-wound-gasket orbits 5 and 5 are made to counter with the above-mentioned outer-ring-of-spiral-wound-gasket orbits 2 and 2. And two or more rolling elements 7 and 7 held by cages 6 and 6, respectively between these outer-rings-of-spiral-wound-gasket orbits 2 and 2 and the inner-ring-of-spiral-wound-gasket orbits 5 and 5 are formed. Therefore, the above-mentioned turning wheel 4 can be freely rotated by the inside of the fixed ring 1.
[0004] It equipped with the seal assembly 8 between the toe (edge which serves as crosswise central approach of vehicles in the state of attachment by vehicles is said, and it is the right end section of drawing 5) periphery side of the above-mentioned turning wheel 4, and the toe inner skin of the fixed ring 1, and inner edge (right end of drawing 5) opening of space 9 portion which installed the above-mentioned rolling elements 7 and 7 is plugged up. This seal

assembly 8 changes from the inside seal ring 10 which carried out outside attachment fixation, and the outside seal ring 11 which inner-******(ed) to the toe of the above-mentioned fixed ring 1 to the shoulder of the inner ring of spiral wound gasket 36 which constitutes the above-mentioned turning wheel 4. Another seal ring 12 has closed outer edge (edge which serves as crosswise outside of vehicles in the state of attachment by vehicles is said, and it is at the left end of drawing 5) opening of the above-mentioned space 9.

[0005] The above-mentioned inside seal ring 10 consists of rodding 13 and a sealant 14. And the tone wheel 15 is installed in the medial surface (right lateral of drawing 5 -6) of rodding 13. This tone wheel 15 built by piercing and fabricating a magnetic board etc. has a gearing configuration as shown in drawing 7 . namely, -- the periphery approach portion of this tone wheel 15 -- tongue-shaped pieces 16 and 16 and notching 17 and 17 -- a circumferencial direction -- continuing -- alternation -- and it forms repeatedly in the ** pitch the tone wheel 15 -- for example, such a configuration -- a ferromagnetic portion, nonmagnetic, or a feeble-magnetism portion -- a circumferencial direction -- continuing -- alternation -- and it has prepared repeatedly in the ** pitch

[0006] Moreover, to inner edge opening (right end opening of drawing 5) of the above-mentioned fixed ring 1, a cross section carries out outside attachment fixation of the covering 18 formed in a circle in the whole by L typeface, and is carrying out support fixation of the sensor 19 inside this covering 18 at it. This sensor 19 consists of arranging in series the permanent magnet 20 continued and magnetized in the direction of inside and outside (longitudinal direction of drawing 5 -6), and the magnetic sensing elements 21, such as a hall device. Such a sensor 19 makes the above-mentioned magnetic sensing element 21 counter the lateral surface of the above-mentioned tone wheel 15 through a minute crevice, and constitutes rotational-speed detection equipment.

[0007] Where the above-mentioned tone wheel 15 and a sensor 19 are installed as mentioned above, the magnetic field which reaches an other end side from the end side of the above-mentioned permanent magnet 20 is formed in the portion containing the above-mentioned magnetic sensing element 21. The density of the magnetic flux which forms this magnetic field becomes high when the end face of the above-mentioned magnetic sensing element 21 and the tongue-shaped pieces 16 and 16 of the above-mentioned tone wheel 15 have countered, and when the above-mentioned end face has countered with the notching 17 and 17 of the above-mentioned tone wheel 15, it becomes low. Change of such flux density is taken out as voltage change by the bridge circuit constituted including the above-mentioned magnetic sensing element 21. Thus, the frequency from which voltage changes is proportional to the rotational speed of a wheel. Therefore, if the above-mentioned voltage is inputted into the controller of ABS or TCS, these ABSs and TCS are controllable proper.

[0008]

[Problem(s) to be Solved by the Invention] With the rotational-speed detection equipment which is constituted as mentioned above and acts. in order to detect the rotational speed of

rotating parts, such as a wheel, correctly, it is necessary to regulate the distance of the end face of a sensor 19, and the side of the tone wheel 15 to accuracy as a design value. When this distance becomes larger than a design value, even if the tone wheel 15 rotates, the rate from which the flux density which passes the magnetic sensing element 21 changes becomes small, and detection of the above-mentioned rotational speed becomes inaccurate. On the other hand, the proper value of the above-mentioned distance needs to regulate the attaching position of a sensor 19 correctly, in order to prevent what (it rubs with rotation of a wheel) the above-mentioned tone wheel 15 and a sensor 19 interfere, enabling it to perform rotational-speed detection correctly, since it is the small value of about 0.5mm.

[0009] On the other hand, it is difficult for the tone wheel 15 and sensor 19 for controlling ABS and TCS to prevent penetration of moisture completely on the relation attached to a wheel, and it originates in a run, car washing, etc. in case of rainy weather, and slight water may advance. Thus, when the water which advanced into the interior of rotational-speed detection equipment carries out cubical expansion by freezing, it is possible that the attaching position of the above-mentioned sensor 19 can be shifted. For example, when the water which entered between covering 18 and the synthetic-resin case 22 which dedicated the permanent magnet 20 and the magnetic sensing element 21 is frozen, the position of a sensor 19 shifts in shaft orientations (longitudinal direction of drawing 5 -6), or the diameter direction (the vertical direction of drawing 5 -6), the above-mentioned distance separates from a proper value, rotational-speed detection may become inaccurate or the above-mentioned tone wheel 15 and a sensor 19 may interfere.

[0010] Furthermore, while it has been in the state which the water which advanced, for example between the portion with fixation also in the times of use, such as between the side of the tone wheel 15 and the end face of a sensor 19, and the portion rotated at the time of use froze, when a turning wheel 4 is started, rotational-speed detection equipment itself may be damaged. The rotational-speed detection equipment of this invention is invented in view of the above situations.

[0011]

[Means for Solving the Problem] The rotational-speed detection equipment of this invention is equipped with the rotational-speed detection equipment known from the former, the sensor similarly supported by the fixed ring which does not rotate at the time of use, and the tone wheel which it is prepared in this fixed ring and this heart, and is rotated at the time of use.

[0012] Especially, in the rotational-speed detection equipment of this invention, it is characterized by installing a heating element the interior or near the above-mentioned sensor or the tone wheel.

[0013]

[Function] The operation situation at the time of the rotational-speed detection equipment of this invention constituted as mentioned above detecting the rotational speed of a turning wheel is the same as that of the rotational-speed detection equipment known from the former.

Especially, in the case of the rotational-speed detection equipment of this invention, it can prevent that the water which advanced into the interior is frozen by energizing to a heating element. Consequently, the depression of rotational-speed detection equipment and the breakage of each part based on the freeze of moisture can be prevented certainly.

[0014]

[Example] Drawing 1 shows the first example of this invention. in addition, arrangement of the tone wheel 15 which constitutes the structure and rotational-speed detection equipment of the portion which this example is what applied this invention to the conventional technology explained by the aforementioned drawing 5 -6, and supports a turning wheel 4, a permanent magnet 20, and the magnetic sensing element 21 etc. -- the above-mentioned -- it is the same as that of the conventional technology the bottom therefore, the explanation which gives the same sign to this conventional technology and equivalent portion, and overlaps -- an ellipsis -- or it is made simple and explains focusing on the feature portion of this invention hereafter

[0015] Outside attachment fixation of the covering 18a by which the cross section was formed in a circle in inner edge opening of the fixed ring 1 in the whole by L typeface is carried out, and support fixation of the synthetic-resin case 22a which built in the sensor 19 inside this covering 18a is carried out. Conventionally which was mentioned above, unlike structure, this synthetic-resin case 22a forms the whole in a circle, and is carrying out embedding of a permanent magnet 20 and the magnetic sensing element 21 to the circumferencial direction part.

[0016] Especially, in the case of the rotational-speed detection equipment of this invention, inside the above-mentioned synthetic-resin case 22a, the simultaneously perimeter of this synthetic-resin case 22a is covered, and embedding of the heating element 23 formed in circle cyclic is carried out. As this heating element 23, various heating elements known from the former, such as a semiconductor heater, a nichrome wire, a carbon film resistor, and metallic-film resistance, are employable, for example. In addition, especially the above-mentioned heating element 23 does not need to be one, covers a circumferencial direction and may be divided into plurality. Furthermore, in the case of the example of illustration, the drain hole 24 is drilled in the portion which exists in the lowest position at the time of wearing to the above-mentioned fixed ring 1 at a part of above-mentioned covering 18a.

[0017] In the case of the rotational-speed detection equipment of this invention constituted as mentioned above, it can prevent that the water which warmed the interior of the above-mentioned covering 18a by energizing to the above-mentioned heating element 23, and advanced into seal assembly 8 portion further inside this covering 18a between synthetic-resin case 22a and covering 18a or between synthetic-resin case 22a and the tone wheel 15 is frozen. Consequently, based on the freeze of moisture, the installation position of the above-mentioned synthetic-resin case 22a shifts, or it is lost that the portions which carry

out relative rotation fix, and the depression of rotational-speed detection equipment and the breakage of each part based on a gap of an installation position can be prevented certainly.

[0018] In addition, the energization to the above-mentioned heating element 23 is performing only a predetermined time, only when there is fear of a freeze based on the signal from the temperature sensor 29 attached to the rotational-speed detection equipment portion by carrying out embedding to the above-mentioned synthetic-resin case 22a etc., as shown in drawing 2 , and it can also suppress exhaustion of a dc-battery. In the case of the structure of drawing 2 , a heating element 23 is made into the shape of a cylinder instead of forming a temperature sensor 29 near the tooth back (right face of drawing 2) of a sensor 19, and interference prevention with a temperature sensor 29 and a heating element 23 is aimed at.

[0019] Moreover, as one example of the time zone energized to a heating element 23, it starts from the time of ending an automobilism, and it is possible to end after sufficient time progress to discharge the water in the above-mentioned covering 18a from a drain hole 24. Moreover, in using it especially in a cold district, while the automobile is running, it can also energize from from to the above-mentioned heating element 23. Based on the signal showing ON of the detecting signal from the above-mentioned temperature sensor 29, or an ignition switch, and OFF etc.; the controller which is not illustrated performs energization control to such a heating element 23.

[0020] Next, drawing 3 shows the second example of this invention. the hub for the first above-mentioned example supporting a driving wheel (the rear wheel of FR vehicle, front wheel of FF vehicle) -- in the case of this example, rotational-speed detection equipment is attached to having attached the rotational-speed detection equipment of this invention to the unit at the non-driving wheel (the front wheel of FR vehicle, rear wheel of FF vehicle) Moreover, in the case of this example, the first above-mentioned example constitutes sensor 19a with a permanent magnet 20, the pole piece 25, and the coil 26 to a permanent magnet 20 and the magnetic sensing elements 21, such as a hall device, having constituted the sensor 19. Furthermore, tone wheel 15a is formed in circle cyclic of magnetic material, and is carrying out outside attachment fixation at the toe of the hub 27 which is a turning wheel. By the medial surface of this tone wheel 15a, each covers a circumferencial direction and forms two or more concaves 28 and 28 which continue in the radiation direction in the above-mentioned sensor 19a and the field which counters at equal intervals. Therefore, the configuration covering the circumferencial direction of this medial surface has the shape of toothing at equal intervals, and will be in the state where the ferromagnetic portion and the feeble-magnetism portion (a concave 28, 28 portions) were repeatedly prepared in this medial surface by turns.

[0021] The electromotive force corresponding to change of the density of magnetic flux which flows the inside of the above-mentioned pole piece 25 is caused in the above-mentioned coil 26. Moreover, the density of the magnetic flux which flows the inside of this pole piece 25 is low the moment the end face of this pole piece 25 counters the above-mentioned concaves 28 and

28, and it becomes high at the moment of countering the portion between concaves 28 and 28. therefore, the electromotive force caused in the above-mentioned coil 26 -- the above -- it changes on the frequency proportional to the rotational speed of a hub 27

[0022] Although this invention is applied to the rotational-speed detection equipment of such structure, in this example. the fixed direct-current bias current which does not change to the coil 26 which constitutes the above-mentioned sensor 19a in itself is passed. This coil 26 generates heat based on this bias current, and it prevents that the moisture which entered in covering 18b freezes. and discharges from a drain hole 24. the above -- when the density of the magnetic flux which flows the above-mentioned pole piece 25 because a hub 27 rotates changes, the output of the above-mentioned coil 26 can be taken out as a direct current which changes focusing on the voltage of the above-mentioned bias current Rotational-speed detection compares with the reference voltage (equal) corresponding to the voltage of the above-mentioned bias current a direct current taken out from the coil 26 to this appearance, is asking for the frequency (or period) in which a direct current exceeds reference voltage (or it is less), and can be performed like the case where a bias current is not passed.

[0023] Next, drawing 4 shows the third example of this invention; this example applies this invention to the rotational-speed detection equipment built into the bearing equipment for supporting a rigid-axle type axle like rear wheels, such as a truck. Outside attachment fixation of the tone wheel 15b is carried out in the periphery side of one inner ring of spiral wound gasket 30 of one pair of inner rings of spiral wound gasket 30 and 30 which carry out outside attachment fixation at the edge of an axle. Gearing-like irregularity was formed in the periphery side of this tone wheel 15b, and the ferromagnetic portion (a part for heights) and the feeble-magnetism portion (a part for a crevice) were repeated to this periphery side by turns, and are prepared in it.

[0024] A through-hole 32 is formed in the periphery side of the above-mentioned tone wheel 15b, and the portion to adjust by the pars intermedia of the outer ring of spiral wound gasket 31 supported by the suspension system, and the sensor 19 which consists of a permanent magnet 20 and the magnetic sensing element 21 inside this through-hole 32 is installed. Embedding of this sensor 19 is carried out to synthetic-resin case 22c, and this synthetic-resin case 22c is covered by covering 18c made from a magnetic metal plate.

[0025] By this example; the crevice 33 was formed in the periphery side of the above-mentioned tone wheel 15b, and the portion which counters by the pars intermedia inner skin of the above-mentioned outer ring of spiral wound gasket 31, and the heating element 23 is formed in this crevice 33 applying this invention to the rotational-speed detection equipment of such structure. And energization to the above-mentioned heating element 23 is enabled with the lead wire 35 which inserted in the through-hole 34 formed in the lower part of the above-mentioned outer ring of spiral wound gasket 31. In addition, since the temperature of the outer-ring-of-spiral-wound-gasket 31 whole of metal [prepared / accepted it in part and / although this heating element 23 had the desirable thing of the inner

skin of the above-mentioned outer ring of spiral wound gasket 31 which a perimeter is covered mostly and established / except for the installation portion of the above-mentioned sensor 19. / it] rises, an antifreeze effect is obtained.

[0026]

[Effect of the Invention] Since the rotational-speed detection equipment of this invention is constituted as it was described above, and it acts, the function of this rotational-speed detection equipment can fall with the moisture which entered in rotational-speed detection equipment, or it can prevent certainly that a component part is damaged.

[Translation done.]

(19)日本国特許庁（ＪＰ） (12) 公開特許公報（A） (11)特許出願公開番号

特開平8－29441

(43)公開日 平成８年(1996) ２月２日

(51)Int.Cl.[6]	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｇ０１Ｐ 3/488		Ｌ		
Ｂ６０Ｔ 8/00		Ａ		

審査請求 未請求 請求項の数１ ＯＬ （全 ６ 頁）

(21)出願番号 特願平6－165404

(22)出願日 平成６年(1994) ７月18日

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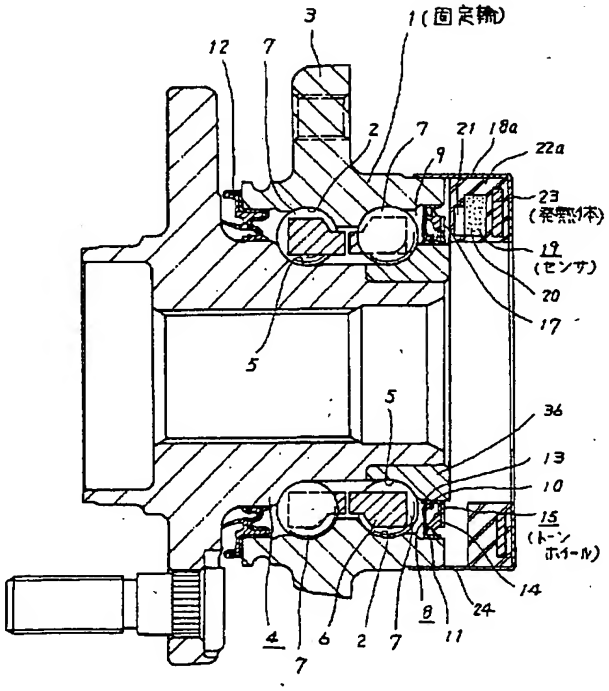
(54)【発明の名称】 回転速度検出装置

(57)【要約】

【目的】 内部に進入した水分が凍結する事で、センサ１９とトーンホイール１５との距離がずれたり、或は構成部品が破損したりする事を防止する。

【構成】 センサ１９を包埋した合成樹脂ケース２２ａ内に、センサ１９の他、発熱体２３を設ける。水分が凍結する可能性がある場合には、この発熱体２３に通電する。カバー１８ａ内に入り込んだ水分は、このカバー１８ａの最下位置に形成した排水孔２４を通じて排出する。



【特許請求の範囲】
【請求項１】　使用時に回転しない固定輪に支持されるセンサと、この固定輪と同心に設けられて使用時に回転するトーンホイールとを備えた回転速度検出装置に於いて、上記センサ若しくはトーンホイールの、内部若しくは近傍に、発熱体を設置した事を特徴とする回転速度検出装置。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】この発明に係る回転速度検出装置は、例えば自動車の車輪を支持する為のハブユニットに組み込んで、この車輪の回転速度を検出する為に利用する。
【０００２】
【従来の技術】自動車のアンチロックブレーキシステム（ＡＢＳ）、或はトラクションコントロールシステム（ＴＣＳ）を制御する為には、車輪の回転速度を検出する必要がある。この為の回転速度検出装置を組み込んだ転がり軸受ユニットが、例えば実開平３－１２８８５６号公報、同５－４０２１号公報、或は米国特許第５０６３３４５号明細書等に記載されている様に、従来から提案されている。図５～７は、この様な回転速度検出装置付の転がり軸受ユニットの構造の１例を示している。
【０００３】使用時に回転しない固定輪１の内周面には複列の外輪軌道２、２を形成している。この固定輪１は、その外周面に形成したフランジ３により、懸架装置に支持される。この固定輪１の内側には、使用時に車輪と共に回転する回転輪４を配置している。この回転輪４の外周面には内輪軌道５、５を設け、これら内輪軌道５、５を、上記外輪軌道２、２と対向させている。そして、これら外輪軌道２、２と内輪軌道５、５との間に、それぞれ保持器６、６により保持された複数の転動体７、７を設けている。従って、上記回転輪４は固定輪１の内側で回転自在である。
【０００４】上記回転輪４の内端部（車両への組み付け状態で車両の幅方向中央寄りとなる端部を言い、図５の右端部）外周面と固定輪１の内端部内周面との間には、シール組立８を装着して、上記転動体７、７を設置した空間９部分の内端（図５の右端）開口部を塞いでいる。このシール組立８は、上記回転輪４を構成する内輪３６の肩部に外嵌固定した内側シール環１０と、上記固定輪１の内端部に内嵌固定した外側シール環１１とから成る。上記空間９の外端（車両への組み付け状態で車両の幅方向外側となる端を言い、図５の左端）開口部は、別のシール環１２により塞いでいる。
【０００５】上記内側シール環１０は、芯金１３とシール材１４とから成る。そして芯金１３の内側面（図５～６の右側面）に、トーンホイール１５を添設している。磁性板を打ち抜き成形する等により造られた、このトーンホイール１５は、図７に示す様な歯車形状を有する。即ち、このトーンホイール１５の外周寄り部分には、舌片１６、１６と切り欠き１７、１７とを、円周方向に亙って交互に且つ等ピッチで繰り返し形成している。トーンホイール１５は、例えばこの様な形状により、強磁性部分と非磁性若しくは弱磁性部分とを、円周方向に亙って交互に且つ等ピッチで繰り返し設けている。
【０００６】又、上記固定輪１の内端開口部（図５の右端開口部）には、断面がＬ字形で全体を円環状に形成されたカバー１８を外嵌固定し、このカバー１８の内側にセンサ１９を支持固定している。このセンサ１９は、内外方向（図５～６の左右方向）に亙り着磁された永久磁石２０と、ホール素子等の磁気検出素子２１とを直列に配置する事で構成されている。この様なセンサ１９は、例えば上記磁気検出素子２１を上記トーンホイール１５の外側面に、微小隙間を介し対向させて、回転速度検出装置を構成する。
【０００７】上記トーンホイール１５とセンサ１９とを上述の様に設置した状態で、上記磁気検出素子２１を含む部分には、上記永久磁石２０の一端面から他端面に達する磁界が形成される。この磁界を形成する磁束の密度は、上記磁気検出素子２１の端面と、上記トーンホイール１５の舌片１６、１６とが対向している場合には高くなり、上記端面が上記トーンホイール１５の切り欠き１７、１７と対向している場合には低くなる。この様な磁束密度の変化は、上記磁気検出素子２１を含んで構成されるブリッジ回路等により、電圧変化として取り出される。この様に電圧が変化する周波数は、車輪の回転速度に比例する。従って、上記電圧をＡＢＳやＴＣＳの制御器に入力すれば、これらＡＢＳやＴＣＳを適正に制御できる。
【０００８】
【発明が解決しようとする課題】上述の様に構成され作用する回転速度検出装置により、車輪等の回転部分の回転速度を正確に検出する為には、センサ１９の端面とトーンホイール１５の側面との距離を、設計値通り正確に規制する必要がある。この距離が設計値よりも大きくなった場合には、トーンホイール１５が回転しても、磁気検出素子２１を通過する磁束密度が変化する割合が小さくなり、上記回転速度の検出が不正確になる。一方、上記距離の適正値は０．５㎜程度の小さな値である為、回転速度検出を正確に行える様にしつつ、上記トーンホイール１５とセンサ１９とが干渉する（車輪の回転に伴って擦れ合う）事を防止するには、センサ１９の取付位置を正確に規制する必要がある。
【０００９】これに対して、ＡＢＳやＴＣＳを制御する為のトーンホイール１５及びセンサ１９は、車輪に付設する関係上、水分の進入を完全に防止する事は難しく、雨天時の走行や洗車等に起因して、僅かな水が進入する可能性がある。この様にして回転速度検出装置の内部に進入した水が、凍結する事で体積膨張した場合、上記セ

ンサ１９の取付位置をずらせる事が考えられる。例えば、カバー１８と、永久磁石２０及び磁気検出素子２１を納めた合成樹脂ケース２２との間に入り込んだ水が凍結した場合には、センサ１９の位置が軸方向（図５～６の左右方向）或は直径方向（図５～６の上下方向）にずれて、上記距離が適正値から外れ、回転速度検出が不正確になったり、或は上記トーンホイール１５とセンサ１９とが干渉する可能性がある。

【００１０】更に、例えばトーンホイール１５の側面とセンサ１９の端面との間等、使用時にも固定のままの部分と使用時に回転する部分との間に進入した水が凍結した状態のまま、回転輪４を起動した場合には、回転速度検出装置自体を破損する可能性もある。本発明の回転速度検出装置は、上述の様な事情に鑑みて発明したものである。

【００１１】

【課題を解決する為の手段】本発明の回転速度検出装置は、従来から知られた回転速度検出装置と同様に、使用時に回転しない固定輪に支持されるセンサと、この固定輪と同心に設けられて使用時に回転するトーンホイールとを備えている。

【００１２】特に、本発明の回転速度検出装置に於いては、上記センサ若しくはトーンホイールの内部若しくは近傍に、発熱体を設置した事を特徴としている。

【００１３】

【作用】上述の様に構成される本発明の回転速度検出装置により、回転輪の回転速度を検出する際の作用事態は、従来から知られた回転速度検出装置と同様である。特に、本発明の回転速度検出装置の場合には、発熱体に通電する事で、内部に進入した水が凍結する事を防止できる。この結果、水分の凍結に基づく回転速度検出装置の機能低下や各部の破損を確実に防止できる。

【００１４】

【実施例】図１は本発明の第一実施例を示している。尚、本実施例は、前記図５～６で説明した従来技術に本発明を適用したもので、回転輪４を支持する部分の構造、並びに回転速度検出装置を構成するトーンホイール１５、永久磁石２０、磁気検出素子２１の配置等は、前述した従来技術と同様である。よって、この従来技術と同等部分には同一符号を付して、重複する説明を省略若しくは簡略にし、以下、本発明の特徴部分を中心に説明する。

【００１５】固定輪１の内端開口部に断面がＬ字形で全体を円環状に形成されたカバー１８ａを外嵌固定し、このカバー１８ａの内側に、センサ１９を内蔵した合成樹脂ケース２２ａを支持固定している。前述した従来構造とは異なり、この合成樹脂ケース２２ａは、全体を円環状に形成し、その円周方向一部に永久磁石２０と磁気検出素子２１とを包埋している。

【００１６】特に、本発明の回転速度検出装置の場合には、上記合成樹脂ケース２２ａの内側には、例えば円輪状に形成された発熱体２３を、この合成樹脂ケース２２ａのほぼ全周に亙り包埋している。この発熱体２３としては、例えば半導体ヒータ、ニクロム線、炭素皮膜抵抗、金属皮膜抵抗等、従来から知られた各種発熱体を採用できる。尚、上記発熱体２３は、特に一体である必要はなく、円周方向に亙って複数に分割されていても良い。更に、図示の実施例の場合には、上記カバー１８ａの一部で、上記固定輪１への装着時に最も低い位置に存在する部分に、排水孔２４を穿設している。

【００１７】上述の様に構成される本発明の回転速度検出装置の場合には、上記発熱体２３に通電する事で上記カバー１８ａの内部を加温し、このカバー１８ａの内部で合成樹脂ケース２２ａとカバー１８ａとの間、或は合成樹脂ケース２２ａとトーンホイール１５との間、更にはシール組立８部分に進入した水が凍結する事を防止できる。この結果、水分の凍結に基づいて上記合成樹脂ケース２２ａの設置位置がずれたり、相対回転する部分同士が固着される事がなくなり、設置位置のずれに基づく回転速度検出装置の機能低下や各部の破損を確実に防止できる。

【００１８】尚、上記発熱体２３への通電は、図２に示す様に、上記合成樹脂ケース２２ａに包埋する等により回転速度検出装置部分に付設した温度センサ２９からの信号に基づき、凍結の恐れがある場合にのみ所定時間だけ行なう事で、バッテリーの消耗を抑える事もできる。図２の構造の場合には、温度センサ２９をセンサ１９の背面（図２の右面）近傍に設ける代わりに発熱体２３を円筒状にして、温度センサ２９と発熱体２３との干渉防止を図っている。

【００１９】又、発熱体２３に通電する時間帯の１例としては、自動車の運転を終了した時点から開始し、上記カバー１８ａ内の水を排水孔２４から排出するのに十分な時間経過後に終了する事が考えられる。又、特に寒冷地で使用する場合には、自動車が走行している間から、上記発熱体２３に通電する事もできる。この様な発熱体２３への通電制御は、上記温度センサ２９からの検出信号やイグニッションスイッチのＯＮ、ＯＦＦを表す信号等に基づき、図示しない制御器が行う。

【００２０】次に、図３は本発明の第二実施例を示している。上述の第一実施例が、駆動輪（ＦＲ車の後輪、ＦＦ車の前輪）を支持する為のハブユニットに本発明の回転速度検出装置を組み付けていたのに対して、本実施例の場合には、非駆動輪（ＦＲ車の前輪、ＦＦ車の後輪）に回転速度検出装置を組み付けている。又、上述の第一実施例が、永久磁石２０とホール素子等の磁気検出素子２１とによりセンサ１９を構成していたのに対して、本実施例の場合には、永久磁石２０とポールピース２５とコイル２６とにより、センサ１９ａを構成している。更に、トーンホイール１５ａは、磁性材により円輪状に形

成され、回転輪であるハブ２７の内端部に外嵌固定している。このトーンホイール１５ａの内側面で上記センサ１９ａと対向する面には、それぞれが放射方向に亙る複数の凹溝２８、２８を、円周方向に亙り等間隔に形成している。従って、この内側面の円周方向に亙る形状は、等間隔の凹凸形状であり、この内側面には強磁性部分と弱磁性部分（凹溝２８、２８部分）とが交互に繰り返し設けられた状態となる。

【００２１】上記コイル２６には、上記ポールピース２５内を流れる磁束の密度の変化に対応した起電力が惹起される。又、このポールピース２５内を流れる磁束の密度は、このポールピース２５の端面が上記凹溝２８、２８に対向する瞬間には低く、凹溝２８、２８の間部分に対向する瞬間には高くなる。従って上記コイル２６に惹起される起電力は、上記ハブ２７の回転速度に比例した周波数で変化する。

【００２２】この様な構造の回転速度検出装置に本発明を適用するのに、本実施例では、上記センサ１９ａを構成するコイル２６に、それ自体は変化しない、一定の直流バイアス電流を流す。このバイアス電流に基づいてこのコイル２６が発熱し、カバー１８ｂ内に入り込んだ水分が凍結するのを防止して、排水孔２４から排出する。上記ハブ２７が回転する事で上記ポールピース２５を流れる磁束の密度が変化した場合に、上記コイル２６の出力は、上記バイアス電流の電圧を中心に変化する直流として取り出せる。回転速度検出は、この様にコイル２６から取り出した直流と、上記バイアス電流の電圧に対応する（等しい）基準電圧とを比較し、直流が基準電圧を上回る（又は下回る）周波数（又は周期）を求める事で、バイアス電流を流さない場合と同様に行える。

【００２３】次に、図４は本発明の第三実施例を示している。本実施例は、トラック等の後輪の様に、リジッドアクスル型の車軸を支持する為の軸受装置に組み込んだ回転速度検出装置に、本発明を適用したものである。車軸の端部に外嵌固定する１対の内輪３０、３０のうちの一方の内輪３０の外周面にトーンホイール１５ｂを外嵌固定している。このトーンホイール１５ｂの外周面には歯車状の凹凸を形成し、この外周面に、強磁性部分（凸部分）と弱磁性部分（凹部分）とを交互に繰り返し設けている。

【００２４】懸架装置に支持される外輪３１の中間部で上記トーンホイール１５ｂの外周面と整合する部分には通孔３２を形成し、この通孔３２の内側に、永久磁石２０と磁気検出素子２１とから成るセンサ19を設置している。このセンサ１９は、合成樹脂ケース２２ｃに包埋されており、この合成樹脂ケース２２ｃは磁性金属板製のカバー１８ｃにより覆われている。

【００２５】この様な構造の回転速度検出装置に本発明を適用するのに、本実施例では、上記外輪３１の中間部内周面で上記トーンホイール１５ｂの外周面と対向する部分に凹部３３を形成し、この凹部３３に発熱体２３を設けている。そして、上記外輪３１の下部に形成した通孔３４を挿通した導線３５により、上記発熱体２３に通電自在としている。尚、この発熱体２３は、上記センサ１９の設置部分を除き、上記外輪３１の内周面のほぼ全周に亙って設ける事が好ましいが、一部にのみ設けただけでも、金属製の外輪３１全体の温度が上昇する為、凍結防止効果は得られる。

【００２６】

【発明の効果】本発明の回転速度検出装置は、以上に述べた通り構成され作用する為、回転速度検出装置内に入り込んだ水分によりこの回転速度検出装置の機能が低下したり、或は構成部品が破損する事を確実に防止できる。

【図面の簡単な説明】

【図１】本発明の第一実施例を示す断面図。

【図２】第一実施例の変形例を示す断面図。

【図３】本発明の第二実施例を示す断面図。

【図４】同第三実施例を示す断面図。

【図５】従来構造の１例を示す断面図。

【図６】図５のＡ部拡大図。

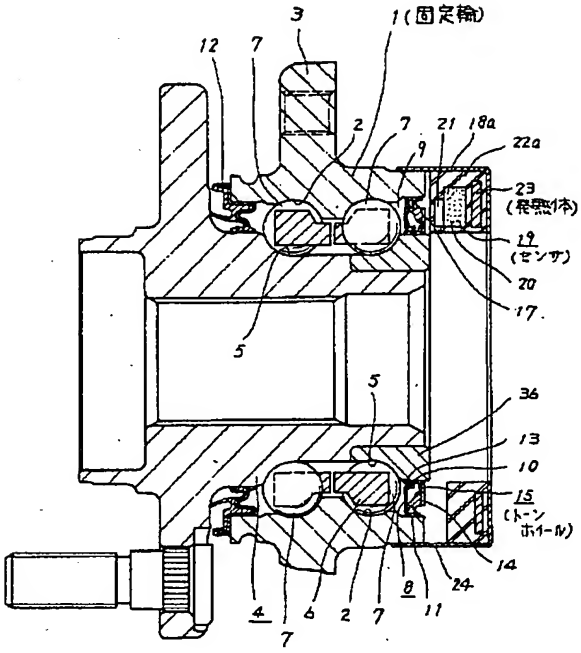
【図７】トーンホイールを図６の側方から見た図。

【符号の説明】

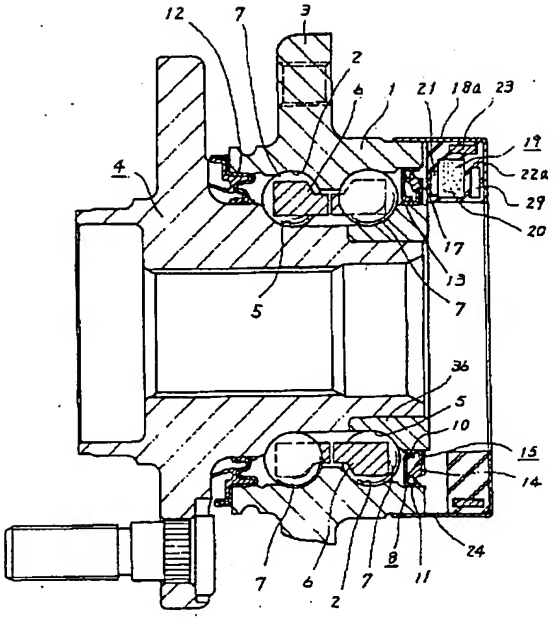
１　固定輪
２　外輪軌道
３　フランジ
４　回転輪
５　内輪軌道
６　保持器
７　転動体
８　シール組立
９　空間
１０　内側シール環
１１　外側シール環
１２　シール環
１３　芯金
１４　シール材
１５、１５ａ、１５ｂ　トーンホイール
１６　舌片
１７　切り欠き
１８、１８ａ、１８ｂ、１８ｃ　カバー
１９、１９ａ　センサ
２０　永久磁石
２１　磁気検出素子
２２、２２ａ、２２ｂ、２２ｃ　合成樹脂ケース
２３　発熱体
２４　排水孔
２５　ポールピース
２６　コイル
２７　ハブ

２８　凹溝
２９　温度センサ
３０　内輪
３１　外輪
３２　通孔
３３　凹部
３４　通孔
３５　導線
３６　内輪

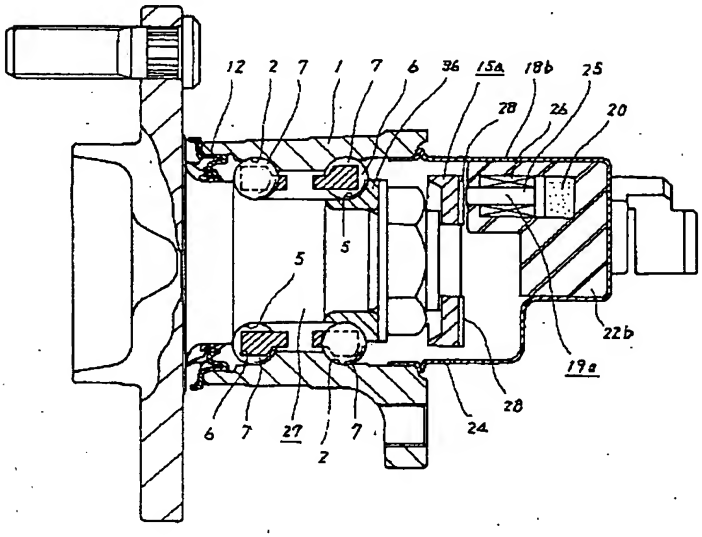
【図１】



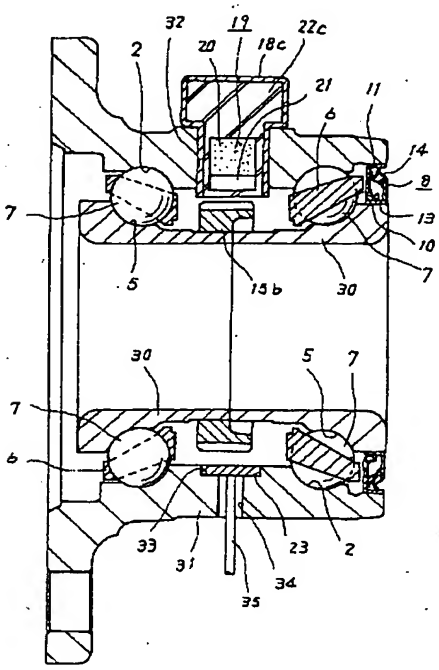
【図２】



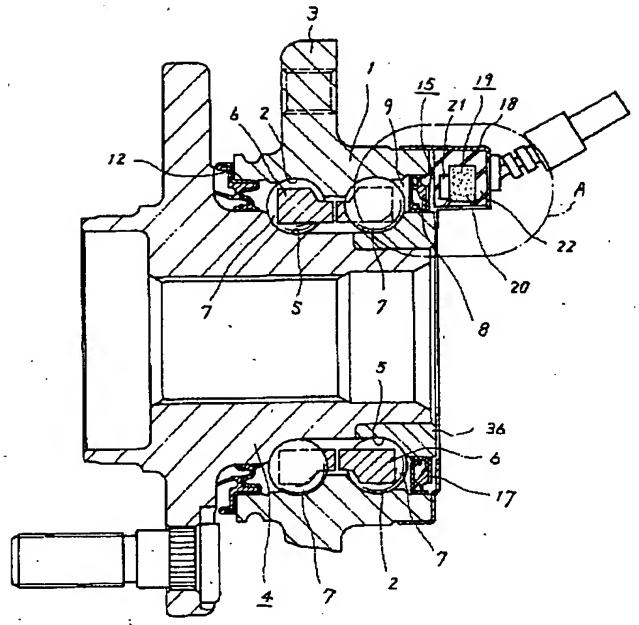
【図３】



【図４】



【図５】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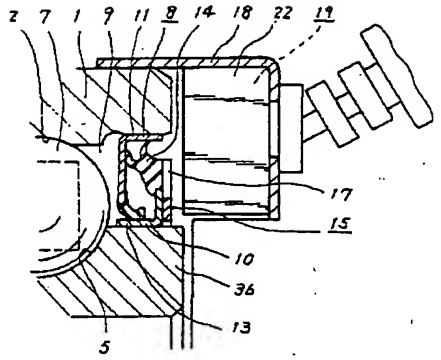
【図６】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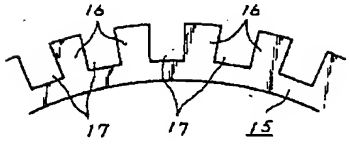
【図７】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DETAILED DESCRIPTION

[Detailed explanation of a design]
[0001]
[Industrial Application] The rolling bearing unit with an acceleration sensor concerning this design is used in order to detect the abnormalities of this rotation supporting section while supporting the wheel of an automobile free [rotation] to a suspension system.
[0002]
[Description of the Prior Art] In order to support the wheel of an automobile free [rotation] to a suspension system, the rolling bearing unit as shown, for example in drawing 5 is used from the former. The inner-ring-of-spiral-wound-gasket equivalent member which constitutes this rolling bearing unit consists of a hub 1 and an inner ring of spiral wound gasket 2. The flange 3 for wheel fixation is formed in the heel (an outer edge means the portion which becomes a crosswise outside edge, when an automobile is equipped, and it is the left end section of drawing 5 .) of the hub 1 of these, and inner-ring-of-spiral-wound-gasket orbital 4a is formed in a pars intermedia periphery side. moreover, the above-mentioned inner ring of spiral wound gasket 2 -- a periphery side -- inner-ring-of-spiral-wound-gasket orbital 4b -- having -- the above -- it is attached outside the pars intermedia periphery side of a hub 1
[0003] the above -- the nut 6 is screwing in the external thread part 5 formed in the toe (inner edge means portion which becomes crosswise central-site edge when automobile is equipped, and it is the right end section of drawing 5 .) periphery side of a hub 1 With screwing to the above-mentioned external thread part 5, this nut 6 presses the inner end face of the above-mentioned inner ring of spiral wound gasket 2, and fixes this inner ring of spiral wound gasket 2 to the predetermined position of the periphery side of a hub 1.
[0004] Moreover, the outer-ring-of-spiral-wound-gasket equivalent member 7 is formed the attachment section 8 for supporting to the suspension system which is not illustrated in a periphery side, and the outer-ring-of-spiral-wound-gasket orbits 9a and 9b of a double row are formed in inner skin, respectively. Between these outer-ring-of-spiral-wound-gasket orbits 9a and 9b and the above-mentioned inner-ring-of-spiral-wound-gasket orbits 4a and 4b, the rolling elements 10 and 10 of every plurality are formed, respectively, and it is supporting free

[rotation of a hub 1] inside the outer-ring-of-spiral-wound-gasket equivalent member 7 supported by the above-mentioned attachment section 8 at the suspension system. Moreover, covering 11 closes inner edge opening of the outer-ring-of-spiral-wound-gasket equivalent member 7, and it is aiming at penetration prevention of the storm sewage inside this outer-ring-of-spiral-wound-gasket equivalent member 7 and dust.

[0005] In the case of a rolling bearing unit which was mentioned above, the wheel fixed to the flange 3 prepared in the heel of a hub 1 can be supported free [rotation] to the suspension system which supported the outer-ring-of-spiral-wound-gasket equivalent member 7.

[0006]

[Problem(s) to be Solved by the Device] By the way, in the rolling bearing unit which is constituted as mentioned above and acts, the front face of the inner-ring-of-spiral-wound-gasket orbits 4a and 4b or the outer-ring-of-spiral-wound-gasket orbits 9a and 9b and also the rolling contact surface of rolling element of rolling elements 10 and 10 exfoliate with the use over a long period of time, and the life as anti-friction bearing is reached.

[0007] However, the operator was not able to know the fact (reach the life) until a hub 1 came to have vibrated greatly with rotation just before the function as anti-friction bearing is lost completely, since there was no mechanism in which it detected that anti-friction bearing has reached the life in the case of the conventional rolling bearing unit.

[0008] However, since a hub 1 comes to vibrate even to the grade which an operator notices, time until this hub 1 becomes rotation impotentia by the inside of the outer-ring-of-spiral-wound-gasket equivalent member 7 is slight. After an operator notices [for this reason] unusually in almost all cases, an automobile cannot be made to be able to run by himself and it cannot carry into a repair shop, until a breakdown truck etc. arrives for this reason -- an automobile -- on the street -- not leaving it -- since it does not obtain but leads also to the cause of traffic congestion, it is not desirable Moreover, when it becomes run impotentia in a place which has neither a house nor a public telephone in near, taking time in connection of a repair request is not avoided.

[0009] That the above problems should be coped with, before becoming run impotentia, the rolling bearing unit with an acceleration sensor of this design is considered so that an operator can be told about having had a margin and the life of anti-friction bearing having come.

[0010]

[Means for Solving the Problem] The rolling bearing unit with an acceleration sensor of this design The inner-ring-of-spiral-wound-gasket equivalent member which has an inner-ring-of-spiral-wound-gasket orbit for the flange for wheel fixation in a heel in a pars intermedia periphery side, respectively, The outer-ring-of-spiral-wound-gasket equivalent member which has the attachment section for supporting to a suspension system in a periphery side, and formed the outer-ring-of-spiral-wound-gasket orbit of a double row in

inner skin, It consists of two or more rolling elements prepared between the above-mentioned inner-ring-of-spiral-wound-gasket orbit and the outer-ring-of-spiral-wound-gasket orbit, covering by which fitting fixation was carried out at the opening edge of the above-mentioned outer-ring-of-spiral-wound-gasket equivalent member, and an acceleration sensor supported inside this covering.

[0011]

[Function] The operation at the time of supporting a wheel free [rotation] to a suspension system by the rolling bearing unit with an acceleration sensor of this design constituted as mentioned above itself is the same as that of the conventional rolling bearing unit mentioned above.

[0012] Furthermore, if anti-friction bearing reaches a life in the case of the rolling bearing unit with an acceleration sensor of this design, the acceleration sensor supported by covering will detect the shimmy generated based on rolling of a rolling element, and the fact which the shimmy generated will be inputted into a controller. And this controller emits the alarm which tells that the above-mentioned anti-friction bearing reached the life.

[0013] The acceleration sensor supported by covering will have sufficient time margin, by the time an inner-ring-of-spiral-wound-gasket equivalent member becomes unable to rotate at all by the inside of an outer-ring-of-spiral-wound-gasket equivalent member, since a shimmy is detectable in the stage in early stages of ****. For this reason, an operator becomes possible [making an automobile run by himself and carrying into a repair shop based on the above-mentioned alarm,].

[0014]

[Example] Drawing 1 -2 show the first example of the rolling bearing unit with an acceleration sensor of this design. Inner-ring-of-spiral-wound-gasket orbital 4a and the step 12 are formed in a pars intermedia periphery side for the flange 3 for fixing a wheel to the heel (left end section of drawing 1) periphery side of the hub 1 which constitutes an inner-ring-of-spiral-wound-gasket equivalent member with the inner ring of spiral wound gasket 2 which following-**. Moreover, where the end side (left end side of drawing 1) is dashed against the above-mentioned step 12, outside attachment support of the inner ring of spiral wound gasket 2 which formed inner-ring-of-spiral-wound-gasket orbital 4b in the periphery side of this hub 1 as well as the periphery side is carried out. However, instead of forming in the periphery side of a hub 1 directly, in a hub 1, inner-ring-of-spiral-wound-gasket orbital 4a may be formed in the inner-ring-of-spiral-wound-gasket member (not shown) of another object, among these may carry out outside attachment fixation of wheel part material and the above-mentioned inner ring of spiral wound gasket 2 in a hub 1, and may be taken as an inner-ring-of-spiral-wound-gasket equivalent member.

[0015] Moreover, the external thread part 5 is formed in the periphery side of the inner edge (right end of drawing 1) approach portion of a hub 1. A nut 6 is screwed in this external thread part 5, and the above-mentioned inner ring of spiral wound gasket 2 is fixed to the

predetermined portion of the periphery side of a hub 1 by binding further.

[0016] The attachment section 8 for fixing this outer-ring-of-spiral-wound-gasket equivalent member 7 to a suspension system is formed in the periphery side of the outer-ring-of-spiral-wound-gasket equivalent member 7. Moreover, each forms in the inner skin of this outer-ring-of-spiral-wound-gasket equivalent member 7 the outer-ring-of-spiral-wound-gasket orbits 9a and 9b which counter the above-mentioned inner-ring-of-spiral-wound-gasket orbits 4a and 4b. And two or more rolling elements 10 and 10 are formed, respectively between one pair of inner-ring-of-spiral-wound-gasket orbits 4a and 4b, and one pair of outer-ring-of-spiral-wound-gasket orbits 9a and 9b, and rotation of the hub 1 inside the outer-ring-of-spiral-wound-gasket equivalent member 7 is enabled.

[0017] moreover -- between the outer edge circles peripheral surface of the above-mentioned outer-ring-of-spiral-wound-gasket equivalent member 7, and the periphery sides of a hub 1 -- a sealant 13 -- equipping -- the inner skin of the outer-ring-of-spiral-wound-gasket equivalent member 7, and the above -- it existed between the hub 1 and the periphery side of an inner ring of spiral wound gasket 2, and outer edge opening of the space in which two or more above-mentioned rolling elements 10 and 10 were formed is plugged up

[0018] On the other hand, covering 14 has closed inner edge (right end of drawing 1) opening of the aforementioned outer-ring-of-spiral-wound-gasket equivalent member 7. This covering 14 is formed in the shape of a cylinder like object with base by carrying out spinning of the metal plate. And the heel of this covering 14 is inner-*******(ed) to inner edge opening of the above-mentioned outer-ring-of-spiral-wound-gasket equivalent member 7. The flange 15 was formed in the periphery side outer edge approach portion of the above-mentioned covering 14, and the lateral surface of this flange 15 is dashed against the inner end face of the above-mentioned outer-ring-of-spiral-wound-gasket equivalent member 7.

[0019] Furthermore, inside the above-mentioned covering 14, in order to detect vibration which joins the above-mentioned outer-ring-of-spiral-wound-gasket equivalent member 7 based on rolling of the above-mentioned rolling elements 10 and 10, the piezo-electricity type acceleration sensor 16 and the amplifier 17 for amplifying the output of this acceleration sensor 16 are supported. While connecting through the through-hole 19 which formed in covering 14 this amplifier 17 and the connector 18 prepared in the medial surface of the above-mentioned covering 14 in the case of the example of illustration, it has prevented that storm sewage and dust advance into covering 14 from the through-hole 19 above-mentioned portion with packing 20.

[0020] In addition, the end of lead wire was connected to the above-mentioned connector 18 through the plug which is not illustrated, and the other end of this lead wire is connected to the controller which is not illustrated too. And when the above-mentioned acceleration sensor 16 detects a shimmy, it is made for this controller to emit an alarm to an operator.

[0021] The operation at the time of supporting a wheel free [rotation] to a suspension system by the rolling bearing unit with an acceleration sensor of this design constituted as mentioned

above itself is the same as that of the conventional rolling bearing unit mentioned above.

[0022] Furthermore. in the case of the rolling bearing unit with an acceleration sensor of this design, with the use over a long period of time, if the rolling contact surface of rolling element of rolling elements 10 and 10 exfoliates further and the life as anti-friction bearing is reached, the front face of the inner-ring-of-spiral-wound-gasket orbits 4a and 4b or the outer-ring-of-spiral-wound-gasket orbits 9a and 9b and the acceleration sensor 16 supported by covering 14 will detect the shimmy generated based on rolling of rolling elements 10 and 10 in the aforementioned outer-ring-of-spiral-wound-gasket equivalent member 7. After this detecting signal is amplified with amplifier 17, it is inputted into the controller which is not illustrated too through a connector 18, the plug which is not illustrated, and lead wire. And based on the signal from this controller, alarm meanses, such as a buzzer and a lamp, emit the alarm which tells that the above-mentioned anti-friction bearing reached the life.

[0023] Since the acceleration sensor supported by covering 14 can detect the above-mentioned shimmy in the stage in early stages of [****] a heterology in front far, by the time the hub 1 which is an inner-ring-of-spiral-wound-gasket equivalent member by the inside of the outer-ring-of-spiral-wound-gasket equivalent member 7 becomes unable to rotate at all; it will have sufficient time margin, rather than an operator notices unusually by vibration. For this reason, an operator becomes possible [making an automobile run by himself and carrying into a repair shop based on the above-mentioned alarm,].

[0024] Next, drawing 3 -4 show the second example of this design. In the case of this example, the rotational-speed detection sensor 21 besides an acceleration sensor 16 is supported inside the covering 14 fixed to inner edge opening of the outer-ring-of-spiral-wound-gasket equivalent member 7. This rotational-speed detection sensor 21 is a thing for detecting the rotational speed of a wheel in order to control an anti-lock brake system (ABS) and a traction control system (TCS).

[0025] For this reason, in the case of this example, the rotational-speed detection sensor 21 is formed inside the above-mentioned covering 14, and also outside attachment fixation of the pulse rotor 23 for rotational-speed detection is carried out at the pillar section 22 formed in the toe of the hub 1 rotated with a wheel. And the nose of cam of the rotational-speed detection sensor 21 of the electromagnetic guidance supported by the above-mentioned covering 14 is made to counter with the concavo-convex section 24 formed in the medial surface of the above-mentioned pulse rotor 23. this sake -- the output signal of the above-mentioned rotational-speed detection sensor 21 -- the above -- since it changes on the frequency proportional to the rotational speed of a hub 1, the controller which is not illustrated according to this frequency controls Above ABS and TCS

[0026] In the case of this example, with the signal from the rotational-speed detection sensor 21, it asks for the rotational speed of a wheel and the life of anti-friction bearing is not only found by the acceleration sensor 16, but can perform control of ABS or TCS.

[0027]

[Effect of the Device] Although the rolling bearing unit with an acceleration sensor of this design is constituted as it was described above. and it acts, since it can know arrival of the life as anti-friction bearing with a margin before losing the function as anti-friction bearing completely. it can prevent the trouble and inconvenient generating accompanying operation of automobiles becoming impossible in the road.

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)実用新案登録公報（Ｙ２）　(11)実用新案登録番号

第2543369号

(45)発行日　平成９年(1997)８月６日　　(24)登録日　平成９年(1997)４月25日

(51)Int.Cl.[6]	識別記号	庁内整理番号	ＦＩ		技術表示箇所
Ｆ１６Ｃ	19/52		Ｆ１６Ｃ	19/52	
	19/00			19/00	
	41/00			41/00	
Ｇ０１Ｐ	15/00		Ｇ０１Ｐ	15/00	Ｃ

請求項の数１(全 5 頁)

(21)出願番号　実願平3－67684

(22)出願日　平成３年(1991)８月１日

(65)公開番号　実開平5－12744

(43)公開日　平成５年(1993)２月19日

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(56)参考文献　特開　昭59－81531（ＪＰ，Ａ）
実開　平３－60069（ＪＰ，Ｕ）
実開　平３－48768（ＪＰ，Ｕ）

(54)【考案の名称】　加速度センサ付転がり軸受ユニット

(57)【実用新案登録請求の範囲】

【請求項１】　外端部に車輪固定用のフランジ部を、中間部外周面に内輪軌道を、それぞれ有する内輪相当部材と、懸架装置に支持する為の取付部を外周面に有し、内周面に複列の外輪軌道を形成した外輪相当部材と、上記内輪軌道と外輪軌道との間に設けられた複数の転動体と、上記外輪相当部材の開口端部に嵌合固定されたカバーと、このカバーの内側に支持された加速度センサとから成る加速度センサ付転がり軸受ユニット。

【考案の詳細な説明】

【０００１】

【産業上の利用分野】この考案に係る加速度センサ付転がり軸受ユニットは、自動車の車輪を懸架装置に対して回転自在に支持すると共に、この回転支持部分の異常を検出する為に利用する。

【０００２】

【従来の技術】自動車の車輪を懸架装置に対して回転自在に支持する為に従来から、例えば図５に示す様な転がり軸受ユニットが使用されている。この転がり軸受ユニットを構成する内輪相当部材は、ハブ１と内輪２とから成る。この内のハブ１の外端部（外端とは、自動車に装着した場合に幅方向外側端部になる部分を言い、図５の左端部。）には車輪固定用のフランジ部３を設け、中間部外周面には内輪軌道４ａを形成している。又、上記内輪２は、外周面に内輪軌道４ｂを有し、上記ハブ１の中間部外周面に外嵌されている。

【０００３】上記ハブ１の内端部（内端とは、自動車に装着した場合に幅方向中央側端部になる部分を言い、図５の右端部。）外周面に形成された雄螺子部５にはナット６が螺合している。このナット６は、上記雄螺子部５

への螺合に伴なって、上記内輪２の内端面を押圧し、この内輪２をハブ１の外周面の所定位置に固定する。

【０００４】又、外輪相当部材７は、図示しない懸架装置に支持する為の取付部８を外周面に、複列の外輪軌道９ａ、９ｂを内周面に、それぞれ形成している。この外輪軌道９ａ、９ｂと上記内輪軌道４ａ、４ｂとの間には、それぞれ複数個ずつの転動体１０、１０を設けて、上記取付部８によって懸架装置に支持された外輪相当部材７の内側に、ハブ１を回転自在に支持している。又、外輪相当部材７の内端開口部はカバー１１により塞ぎ、この外輪相当部材７の内側への、雨水や塵芥の進入防止を図っている。

【０００５】上述した様な転がり軸受ユニットの場合、ハブ１の外端部に設けられたフランジ部３に固定された車輪を、外輪相当部材７を支持した懸架装置に対し、回転自在に支持出来る。

【０００６】

【考案が解決しようとする課題】ところで、上述の様に構成され作用する転がり軸受ユニットに於いては、長期間に亙る使用に伴なって内輪軌道４ａ、４ｂや外輪軌道９ａ、９ｂの表面、更には転動体１０、１０の転動面が剥離し、転がり軸受としての寿命に達する。

【０００７】ところが、従来の転がり軸受ユニットの場合、転がり軸受が寿命に達している事を検出する機構がなかった為、転がり軸受としての機能が完全に失われる直前で、ハブ１が回転に伴なって大きく振動する様になる迄、運転者はその事実（寿命に達している事）を知る事が出来なかった。

【０００８】ところが、運転者が気付く程度に迄ハブ１が振動する様になってから、このハブ１が外輪相当部材７の内側で回転不能になる迄の時間は僅かである。この為、殆どの場合、運転者が異常に気付いてから、自動車を自走させて修理工場に持ち込む事は出来ない。この為、レッカー車等が到着する迄、自動車を路上に放置せざるを得ず、交通渋滞の原因にも繋がる為、好ましくない。又、近くに人家や公衆電話がない様な場所で走行不能になった場合、修理依頼の連絡に手間取る事が避けられない。

【０００９】本考案の加速度センサ付転がり軸受ユニットは、上述の様な問題に対処すべく、走行不能になる前に、余裕を持って転がり軸受の寿命が来た事を運転者に知らせる事が出来る様に考えられたものである。

【００１０】

【課題を解決する為の手段】本考案の加速度センサ付転がり軸受ユニットは、外端部に車輪固定用のフランジ部を、中間部外周面に内輪軌道を、それぞれ有する内輪相当部材と、懸架装置に支持する為の取付部を外周面に有し、内周面に複列の外輪軌道を形成した外輪相当部材と、上記内輪軌道と外輪軌道との間に設けられた複数の転動体と、上記外輪相当部材の開口端部に嵌合固定されたカバーと、このカバーの内側に支持された加速度センサとから構成される。

【００１１】

【作用】上述の様に構成される本考案の加速度センサ付転がり軸受ユニットにより、車輪を懸架装置に対して回転自在に支持する際の作用自体は、前述した従来の転がり軸受ユニットと同様である。

【００１２】更に、本考案の加速度センサ付転がり軸受ユニットの場合、転がり軸受が寿命に達すると、カバーに支持された加速度センサが、転動体の転動に基づいて発生する異常振動を検出して、異常振動が発生した事実を制御器に入力する。そしてこの制御器が、上記転がり軸受が寿命に達した事を知らせる警報を発する。

【００１３】カバーに支持された加速度センサは、極く初期の段階で異常振動を検出出来る為、外輪相当部材の内側で内輪相当部材が全く回転出来なくなる迄の間に十分な時間的余裕がある。この為、運転者は上記警報に基づき、自動車を自走させて修理工場に持ち込む事が可能となる。

【００１４】

【実施例】図１～２は本考案の加速度センサ付転がり軸受ユニットの第一実施例を示している。次述する内輪２と共に内輪相当部材を構成するハブ１の外端部（図１の左端部）外周面には、車輪を固定する為のフランジ部３を、中間部外周面には、内輪軌道４ａと段部１２とを形成している。又、このハブ１の外周面には、その外周面に同じく内輪軌道４ｂを形成した内輪２を、その一端面（図１の左端面）を上記段部１２に突き当てた状態で、外嵌支持している。但し、内輪軌道４ａは、ハブ１の外周面に直接形成する代りに、ハブ１とは別体の内輪部材（図示せず）に形成し、この内輪部材と上記内輪２とを、ハブ１に外嵌固定して、内輪相当部材とする場合もある。

【００１５】又、ハブ１の内端（図１の右端）寄り部分の外周面には、雄螺子部５を形成している。この雄螺子部５にはナット６を螺合し、更に緊締する事で、上記内輪２をハブ１の外周面の所定部分に固定している。

【００１６】外輪相当部材７の外周面には、この外輪相当部材７を懸架装置に固定する為の取付部８を設けている。又、この外輪相当部材７の内周面には、それぞれが上記内輪軌道４ａ、４ｂに対向する、外輪軌道９ａ、９ｂを形成している。そして、１対の内輪軌道４ａ、４ｂと１対の外輪軌道９ａ、９ｂとの間に、それぞれ複数の転動体１０、１０を設けて、外輪相当部材７の内側でのハブ１の回転を自在としている。

【００１７】又、上記外輪相当部材７の外端部内周面と、ハブ１の外周面との間には、シール材１３を装着して、外輪相当部材７の内周面と上記ハブ１並びに内輪２の外周面との間に存在し、上記複数の転動体１０、１０を設けた空間の外端開口部を塞いでいる。

【００１８】一方、前記外輪相当部材７の内端（図１の右端）開口部は、カバー１４により塞いでいる。このカバー１４は、金属板を絞り加工する事により、有底筒状に形成されている。そして、このカバー１４の外端部を上記外輪相当部材７の内端開口部に、内嵌固定している。上記カバー１４の外周面外端寄り部分には鍔部１５を形成し、この鍔部１５の外側面を、上記外輪相当部材７の内端面に突き当てている。

【００１９】更に、上記カバー１４の内側には、上記転動体１０、１０の転動に基づいて上記外輪相当部材７に加わる振動を検出する為、圧電型の加速度センサ１６と、この加速度センサ１６の出力を増幅する為のアンプ１７とを支持している。図示の実施例の場合、このアンプ１７と上記カバー１４の内側面に設けたコネクタ１８とを、カバー１４に形成した通孔１９を通じて接続すると共に、パッキング２０によって、上記通孔１９部分からカバー１４内に雨水や塵芥が進入するのを防止している。

【００２０】尚、上記コネクタ１８には、図示しないプラグを介して導線の一端を接続し、この導線の他端は、やはり図示しない制御器に接続している。そしてこの制御器は、上記加速度センサ１６が異常振動を検出した場合に、運転者に警報を発する様にしている。

【００２１】上述の様に構成される本考案の加速度センサ付転がり軸受ユニットにより、車輪を懸架装置に対して回転自在に支持する際の作用自体は、前述した従来の転がり軸受ユニットと同様である。

【００２２】更に、本考案の加速度センサ付転がり軸受ユニットの場合、長期間に亙る使用に伴なって内輪軌道４ａ、４ｂや外輪軌道９ａ、９ｂの表面、更には転動体１０、１０の転動面が剥離し、転がり軸受としての寿命に達すると、カバー１４に支持された加速度センサ１６が、転動体１０、１０の転動に基づいて前記外輪相当部材７に発生する異常振動を検出する。この検出信号は、アンプ１７によって増幅されてから、コネクタ１８、図示しないプラグ並びに導線を介して、やはり図示しない制御器に入力される。そしてこの制御器からの信号に基づいて、ブザー、ランプ等の警報手段が、上記転がり軸受が寿命に達した事を知らせる警報を発する。

【００２３】カバー１４に支持された加速度センサは、運転者が振動により異常に気付くよりも遙か前で、異常発生の極く初期の段階で上記異常振動を検出出来る為、外輪相当部材７の内側で内輪相当部材であるハブ１が全く回転出来なくなる迄の間に十分な時間的余裕がある。この為、運転者は上記警報に基づき、自動車を自走させて修理工場に持ち込む事が可能となる。

【００２４】次に、図３～４は、本考案の第二実施例を示している。本実施例の場合、外輪相当部材７の内端開口部に固定したカバー１４の内側に、加速度センサ１６の他、回転速度検出センサ２１を支持している。この回転速度検出センサ２１は、アンチロックブレーキシステム（ＡＢＳ）やトラクションコントロールシステム（ＴＣＳ）を制御する為、車輪の回転速度を検出する為のものである。

【００２５】この為に本実施例の場合、上記カバー１４の内側に回転速度検出センサ２１を設ける他、車輪と共に回転するハブ１の内端部に形成した円柱部２２に、回転速度検出用のパルスロータ２３を外嵌固定している。そして、上記カバー１４に支持された電磁誘導式の回転速度検出センサ２１の先端を、上記パルスロータ２３の内側面に形成された凹凸部２４と対向させている。この為、上記回転速度検出センサ２１の出力信号は、上記ハブ１の回転速度に比例した周波数で変化するので、この周波数に応じて図示しない制御器が、上記ＡＢＳやＴＣＳを制御する。

【００２６】本実施例の場合、加速度センサ１６により転がり軸受の寿命を知れるだけでなく、回転速度検出センサ２１からの信号により、車輪の回転速度を求め、ＡＢＳやＴＣＳの制御を行なえる。

【００２７】

【考案の効果】本考案の加速度センサ付転がり軸受ユニットは、以上に述べた通り構成され作用するが、転がり軸受としての寿命の到来を、転がり軸受としての機能が完全に失われる以前に余裕を持って知る事が出来る為、路上で自動車の運行が不能になる事に伴なう面倒や不都合の発生を防止出来る。

【図面の簡単な説明】

【図１】本考案の第一実施例を示す断面図。

【図２】図１のＡ－Ａ断面図。

【図３】本考案の第二実施例を示す断面図。

【図４】図３のＢ－Ｂ断面図。

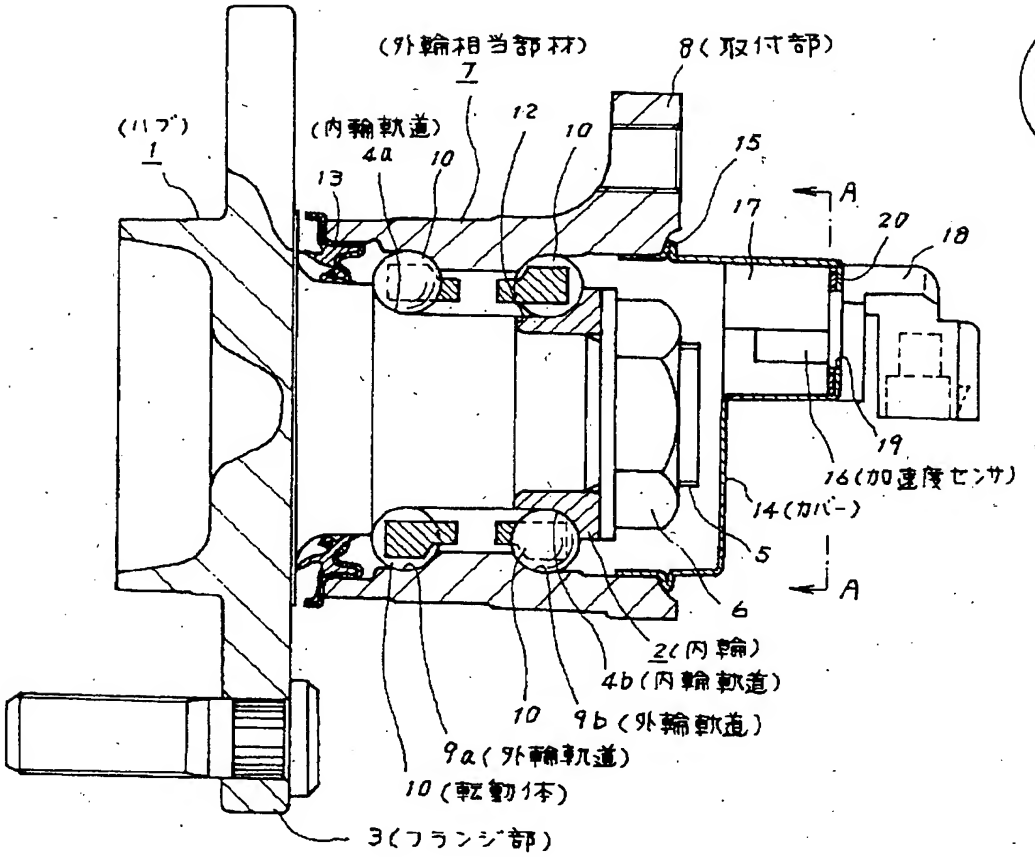
【図５】従来例を示す断面図。

【符合の説明】

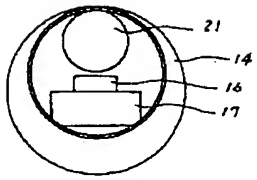
１　ハブ
２　内輪
３　フランジ部
４ａ　内輪軌道
４ｂ　内輪軌道
５　雄螺子部
６　ナット
７　外輪相当部材
８　取付部
９ａ　外輪軌道
９ｂ　外輪軌道
１０　転動体
１１　カバー
１２　段部
１３　シール材
１４　カバー
１５　鍔部

１６　加速度センサ
１７　アンプ
１８　コネクタ
１９　通孔
２０　パッキング
２１　回転速度検出センサ
２２　円柱部
２３　パルスロータ
２４　凹凸部

【図１】



【図４】



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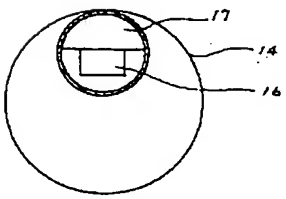

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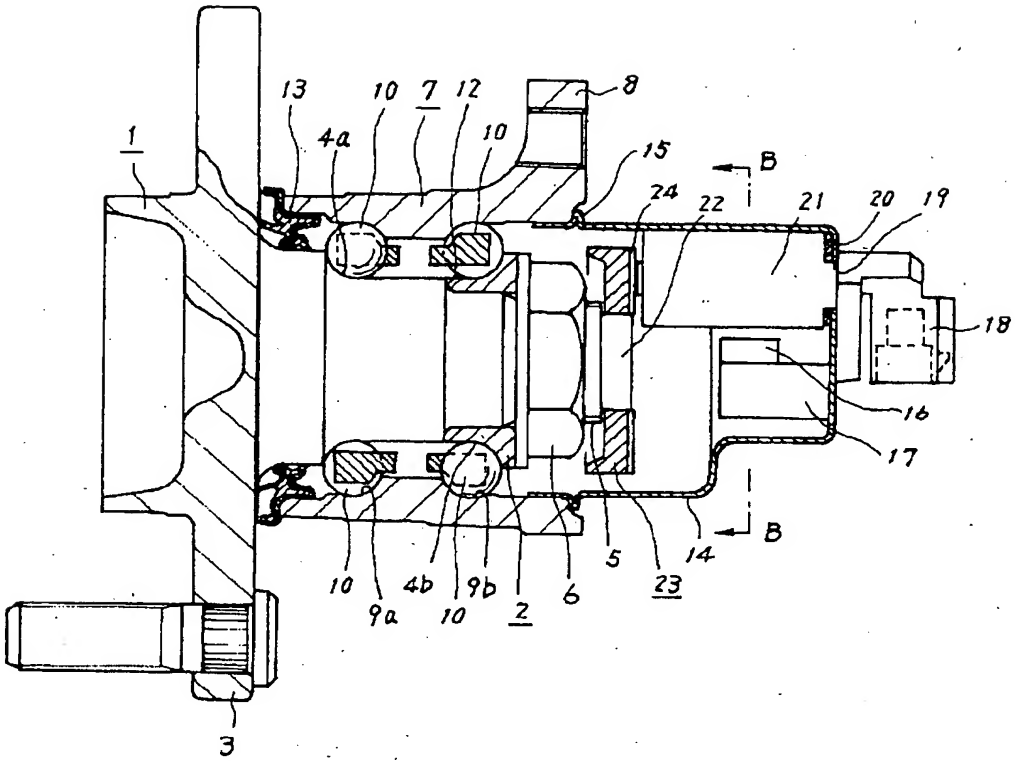
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10
7
12
8
4a
10
1
15
B
24
22
21
20
19
18
16
17
B
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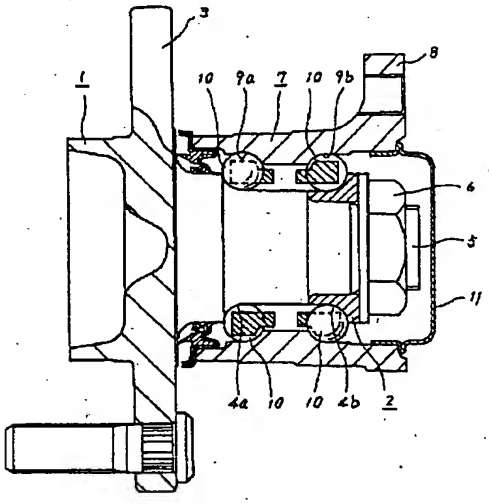
5
23
10
9a
4b
10
9b
2
6
3

【図５】


3
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4b
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 :
B61K 9/12, 9/04, B61F 15/20, G01M 13/04

A1

(11) International Publication Number: WO 00/51869

(43) International Publication Date: 8 September 2000 (08.09.00)

(21) International Application Number: PCT/EP00/01690

(22) International Filing Date: 29 February 2000 (29.02.00)

(30) Priority Data:
TO99A000164 4 March 1999 (04.03.99) IT

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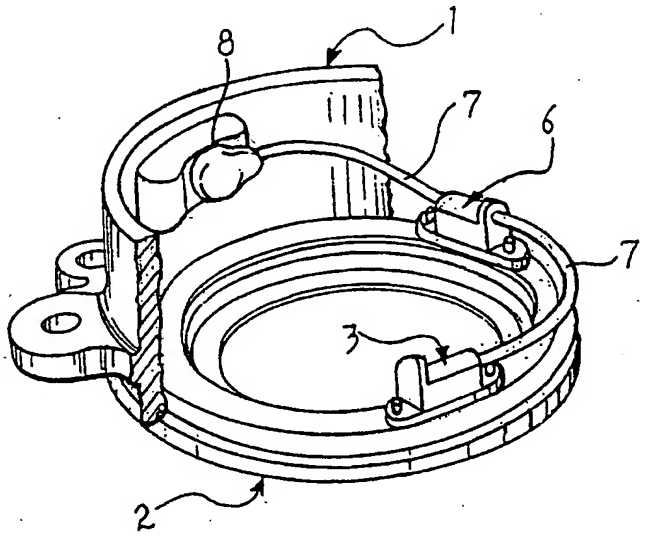
(81) Designated States: AU, CA, JP, KR, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: A RAILWAY AXLE HUB UNIT

(57) Abstract

A railway axle hub unit of the type comprising an axle box housing (1) for supporting a bearing, is provided with a sensor body (3, 9) containing sensors (4, 5) for detecting vibration in the vertical direction and the horizontal axial direction. The sensor body is mounted onto a stationary support element (2, 1, 15) rigidly secured to the bearing, preferably an annular sealing insert. The sensors perform monitoring of the operation condition of the hub unit by generating and transmitting signals indicative of the detected level of vibration to an electronic processing unit mounted on board of the railway vehicle or the train. The processing unit is capable of signalling in real time an impending failure and/or a damaged condition associated with the monitored hub unit.



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A railway axle hub unit

Technical Field

The present invention refers to a railway axle hub unit of the type comprising an axle box housing for supporting a bearing.

Background Art

Mechanical deterioration of the axle supporting bearings, besides adversely affecting the operational performance of the axle, also reduces the safety of the vehicle and may lead to the failure of the bearing, with catastrophic consequences such as derailment.

The main structural or functional defects which bearings of the above kind or the relative wheel are subject to can be summarised as follows:

- manufacturing or assembling defects of the bearing, which provoke an excessive play between its components (inner and outer raceways, rolling bodies, retaining cages, sealing devices, shoulders defining the axial position of the bearing with respect to the axle); cracks or spalls due to fatigue; local pitting due to an electrical current passing through the bearing; rust marks;
- insufficient lubrication of the inner parts of the bearing; polluted or deteriorated lubricant;
- flats in the rolling surface of a wheel due to the wheel being locked while the railway vehicle is travelling; excessive wear of the wheel profile in the rail contact zone;
- axial play of the wheel with respect to the axle, whereby the rotation axis of the wheel is not perpendicular to a

vertical plane.

Up to now methods of checking the conditions of the bearings have been limited to periodical maintenance interventions. With such interventions, all the bearings of a same vehicle are replaced regardless of their conditions, including bearings being still valid and not needing to be replaced.

It will be understood that this way of proceeding first of all involves high costs of labour and passive costs for leaving the vehicle unused, but above all it does not allow to predict or detect the occurrence of failures in time before the bearing is so deteriorated to represent a condition of potential danger. Therefore, there is the risk of continuing to use a defective bearing or wheel for prolonged periods till the moment set by the maintenance schedule for replacement.

U.S. Patent No. 5,433,111 discloses an apparatus for detecting defective conditions associated with a set of railway vehicle wheels and with a railtrack upon which a given railway vehicle travels. The apparatus comprises measurement means for generating data indicative of rotational rate of the wheels, a set of accelerometers adapted to generate data indicative of motion along three orthogonal axes, wherein one of the axes is generally vertical with respect to the railtrack, and a data processor adapted to detect, based on the received rotational rate and motion data, a defective condition associated with at least one wheel of the vehicle.

U.S. Patent No. 5,381,692 refers to a monitoring system of a bearing assembly for supporting the drive shaft of a helicopter. The system has a vibration sensor for providing signals indicative of the vibrations emanating from the bearing as-

sembly, first temperature sensing means for providing signals indicative of the bearing assembly operating temperature and second temperature sensing means for providing signals indicative of the ambient temperature. An alarm subsystem in response to the vibration and temperature signals provides an alarm signal warning of degradation condition of the bearing.

Disclosure of Invention

It is an object of the present invention to predict and/or identify in time and give a warning of the presence of a defect, the kind of defect and its precise location, in particular distinguishing which wheel of the vehicle or train is affected by the defect, and more particularly distinguishing whether the defect is affecting the wheel, its bearing or one of the components of the latter.

Another object of the present invention is to provide a continuous and real time monitoring of the operating condition of the bearing to obtain real time information concerning the variation of the defect in time, so that it is possible to intervene with urgency for severe failures, or delay intervention depending on the gravity of the detected failure, or consider the opportunity of not intervening, for example when an operation defect is stabilised or is stabilising.

Another object of the invention is to optimise maintenance, so as to intervene only when it is appropriate or necessary, and replace only the bearing individuated as defective or worn out.

These and other objects, which will be better understood herein after, are achieved according to the present invention by a railway axle hub unit of the type comprising an axle box

housing for supporting a bearing, characterised by being equipped with sensor means for detecting vibration in a generally vertical direction, said sensor means being mounted onto a stationary support element rigidly secured to the bearing, said sensor means being adapted for generating and transmitting signals indicative of the detected level of vibration to an electronic processing unit on board of the railway vehicle or the train, whereby said processing unit is capable of signalling in real time an impending failure and/or a damaged condition associated with said monitored hub unit.

A further object of the invention is to provide a hub unit equipped with vibration sensors located at an optimal position for detecting the vibrations which the bearing and the wheel are subjected to, and for individuating correctly the nature, the location and the extent of possible defects.

This object is accomplished by a hub unit having the features defined in claims 2 to 4.

Further important features are defined in the other depending claims.

Brief Description of Drawings

The characteristics and advantages of the invention will become apparent from the detailed description of a few embodiments thereof with reference to the appended drawings, provided purely by way of non-limiting example, in which:

- figure 1 is a perspective view, with some parts broken off, showing the inside of a housing of the bearing and sensors unit according to the present invention;
- figure 2 is a perspective view, with some parts broken

off, showing the outside of the housing of figure 1;

- figure 3 is a perspective view, to an enlarged scale, of a sensor carrier body equipped with two vibration sensors oriented in different directions;
- figures 4 and 5 are front views schematically showing two respective variants of the sensor carrier body of figure 3; and
- figure 6 is a partial cross sectional view of a further variant of a sensor carrier.

Modes for Carrying Out the Invention

Referring initially to figure 1, numeral 1 designates overall a substantially cylindrical bearing housing fixable in known manner to a railway vehicle for supporting a rolling contact bearing housed therein and not shown for simplicity.

A metal annular insert 2, adapted for sealing the bearing from the outboard side, is press fitted onto the radially outer race (indicated 17 in figure 6) of the axle bearing. Preferably, the sealing insert 2 is made of cold forged steel plate about 2 mm thick.

With reference also to figure 3, in accordance with the invention, mounted on the sealing insert 2 is a sensor body 3 containing a bi-directional accelerometer device comprised of a first accelerometer 4 oriented in the vertical direction and a second accelerometer 5 oriented in the horizontal axial direction.

Advantageously, the sensor body 3 is positioned on the sealing insert 2 at a position vertically aligned with the axis of rotation of the bearing, where the vibrations are more intense. Preferably, the sensor body is positioned in the

higher part of the insert (in other words at 12 o'clock), i.e. in correspondence of the zone where the rolling bodies of the bearing undergo the maximum load.

The sensor body 3 forms a base portion 3a for resting onto a radial surface 2a of the sealing insert 2, with a pair of bores 3b for allowing the passage of respective fastening elements (not shown) for securing in removable manner the sensor body 3 to the insert 2.

The accelerometers 4 and 5 are preferably of the piezoelectric type, associated with respective amplifiers (not shown) incorporated in the sensor body.

The accelerometer 4 detects vertical vibrations which the bearing/wheel assembly is subjected to. The accelerometer 5 serves to detect horizontal vibrations provoked by the wheel rim hitting against the rail as the vehicle oscillates along the track.

In the example shown in figure 1, a further sensor body indicated overall at 6 is mounted on the sealing insert 2 at a location distinct from where the sensor body 3 is fitted. The sensor body 6 incorporates motion sensors, such as a rotational speed sensor detecting the passage of the poles of a magnetised ring rotating fast with the rotating race of the bearing, and possibly other motion sensors such as a sensor for detecting the direction of rotation.

Differently from what is shown by way of example in figure 1, all the sensors which the housing is equipped with may be incorporated in a single sensor body 3, as shown in figure 3. In this case the sealing insert 2 has an aperture (not shown) at the location of sensor body 3 for allowing the motion sen-

sors to face the aforesaid magnetised ring.

In a preferred embodiment, besides the vibration and motion sensors, also a temperature sensor (not shown) is included for signalling the occurrence of temperatures higher than those of normal operation and indicating that the friction within the bearing is exceeding a pre-set threshold value of admissibility.

The signals generated by the various sensors are transmitted through a cable 7 to a multi-pin connector 8 mounted on the same housing 1.

From the connector 8, the various signals from the various sensors are transmitted to an electronic processing unit (not shown) mounted on board of the railway vehicle or train. Said unit processes the received signals and is provided with suitable software adapted for recognising conditions of defective operation, such as e.g. excessively high temperature or irregular vibration frequencies related to determined defects, and once a defect has been detected, signalling its presence and variation with time.

When at least one of the signals related to one of the monitored parameters exceeds a predetermined threshold level, the processing unit generates an alarm signal that allows to intervene at the right moment to remove the defect and restore conditions of safe and correct operation.

The parameters may indifferently be monitored continuously or periodically, according to requirements or to the gravity of the defect possibly detected.

According to an alternative embodiment of the invention,

shown in figures 4 and 5, the sensor body may have the shape of a hollow cylinder 9 adapted to be secured, for example by screwing, in a recessed seat 10 formed directly in the housing 1. A capsule 11 containing the above sensors is locked within the cylinder 9.

In the variant of figure 4, the seat 10 is formed and dimensioned with two different diameters so that the sensor body 9, once fitted in the seat 10, remains flush with the outer surface 12 of the housing 1.

In the variant of figure 5, the cylindrical body 9 is designed to project outwardly of the housing and is coupled thereto by means of a lower threaded portion 13.

In the variant of figure 6, a flange portion 9a is integrally formed with the sensor body 9. The flange portion 9a serves to rest and fix the sensor body 9 onto an outer surface 14 of the housing 1 or, as is the case of the example of figure 6, a cover member 15 that closes the housing 1 on the outboard side. The flange portion 9a has a pair of bores 16 (only one of which is shown in figure 6) for accommodating fastening elements, for example screws or bolts, for removably securing the sensor body 9 to the cover member 15 (or the housing 1). In this way the sensor body is accessible from the outside whereby it can be removed easily for overhauling or replacing the sensors. Furthermore, the variant of figure 6 is advantageous in that is applicable to any kind of conventional axle unit. In figure 6, numeral 17 designates the outer, stationary race of the bearing, and numeral 18 designates the inner race rotating fast with the axle 19 and an impulse ring or phonic wheel 20. A sensor (not shown) for detecting the rotational speed of axle 19 is mounted in the radially inner end portion 9b of the sensor body 9 and projects through an open-

ing 15a of the cover member 15 so as to operationally face the impulse ring 20. It should be noted that the sensor body 9 may also accommodate a temperature sensor and/or other motion sensors of known kind.

It will be appreciated that the present invention allows to identify the precise location and nature of a defect, and to distinguish and distinctly signal the several defects listed in the introductory part of the description. The processing unit software is capable of distinguishing whether vibrations are caused by defects of the bearing/wheel assembly or simply due to the passage of the vehicle over deflected rails or switches.

Locating the vibration sensors at the shield of the sealing device has turned out to be particularly advantageous, especially for reading vibration signals. Whilst it is not desired to be bound to any specific theory in this connection, tests carried out by the Applicant show that the sealing insert, by virtue of its stiff and thin structure intimately fixed to the bearing, constitutes an ideal path for the transmission of vibration.

Moreover, locating the sensors on the sealing insert keeps some space free within the housing to be possibly used for mounting therein a power generator for supplying current to the electronics for analysing the monitored signals. This possibility is of particular interest for applications on wagons having no electric supply.

While only certain features of the invention have been described and illustrated herein, many modifications, substitutions, changes and equivalents will now occur to those skilled in the art. For example, the detected signals can be

transmitted by wire or radio transmission to a general processing unit located in a remote position, e.g. in the driver's cab.

CLAIMS

1. A railway axle hub unit of the type comprising an axle box housing (1) for supporting a bearing, characterised by being equipped with sensor means (4) for detecting vibration in a generally vertical direction, said sensor means (4) being mounted onto a stationary support element (2, 1, 15) rigidly secured to the bearing, said sensor means being adapted for generating and transmitting signals indicative of the detected level of vibration to an electronic processing unit on board of the railway vehicle or the train, whereby said processing unit is capable of signalling in real time an impending failure and/or a damaged condition associated with said monitored hub unit.

2. A hub unit as claimed in claim 1, characterised in that said stationary support element is a sealing annular insert (2) of sheet metal secured to the stationary outer race of the bearing.

3. A hub unit as claimed in claim 1, characterised in that said sensor means (4) are mounted onto said stationary support element (2, 1, 15) at a position vertically aligned with the axis of rotation of the bearing.

4. A hub unit as claimed in claim 3, characterised in that said sensor means (4) are mounted onto said stationary support element (2, 1, 15) at a position vertically aligned above the axis of rotation of the bearing.

5. A hub unit as claimed in claim 1, characterised in that said sensor means (4) are incorporated in a sensor body (3, 9) further including sensor means (5) for detecting vibration in a horizontal, axial direction.

6. A hub unit as claimed in claim 1, characterised in that it further comprises sensor means for detecting the temperature of the bearing.

7. A hub unit as claimed in claim 1, characterised in that it further comprises sensor means for gauging the rotational speed of the axle and/or the direction of rotation of the axle.

8. A hub unit as claimed in any of claims 5 to 7, characterised in that all said sensor means are housed within a single sensor body (3, 9).

9. A hub unit as claimed in claim 1, characterised in that said stationary support element is the axle box housing (1) or a cover member (15) closing said housing from the outboard side.

FIG. 1

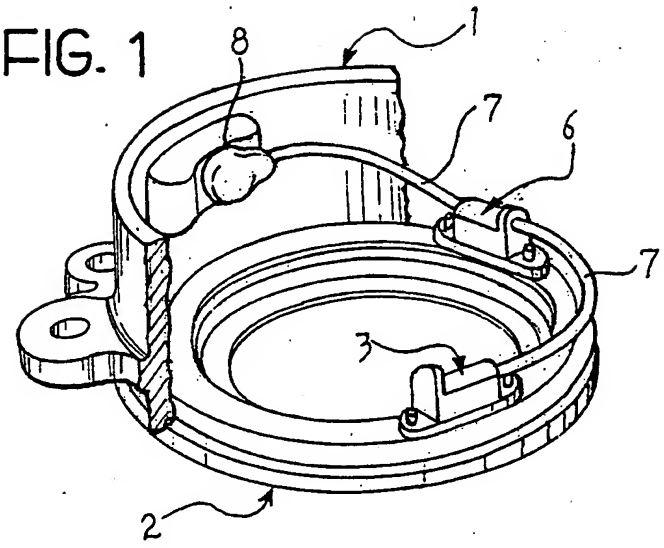


FIG. 2

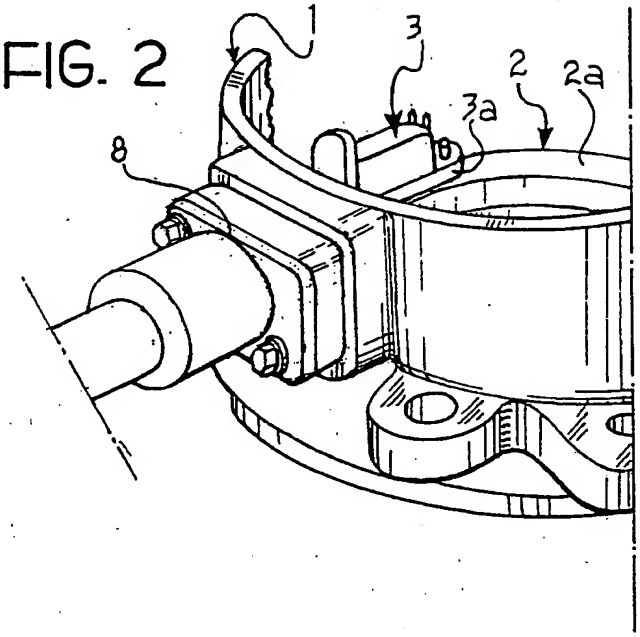


FIG. 3

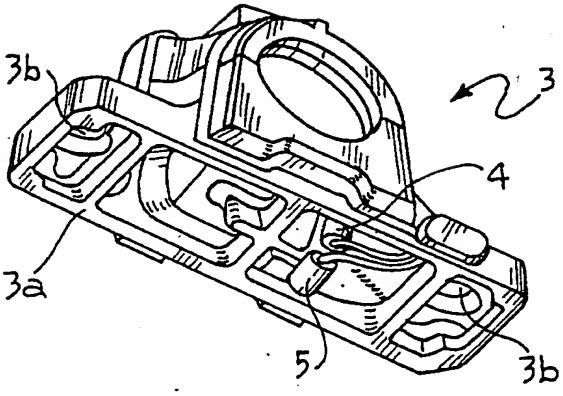


FIG. 4

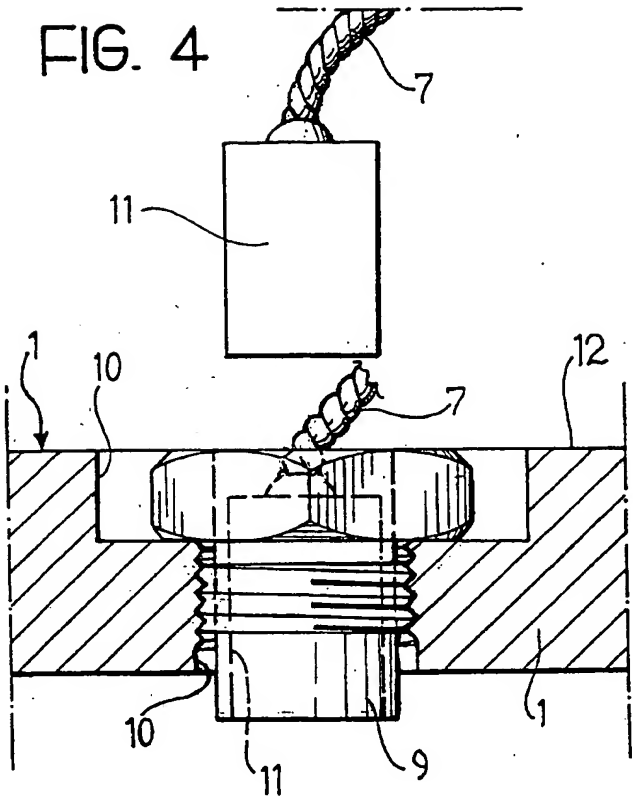


FIG. 5

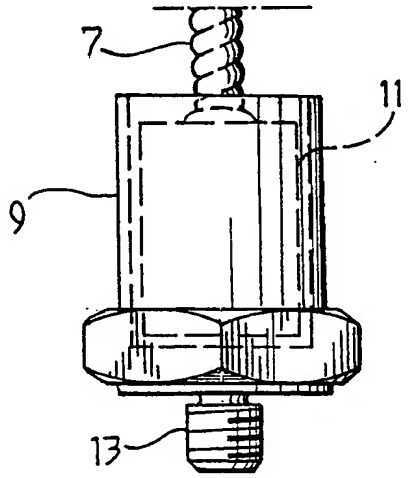
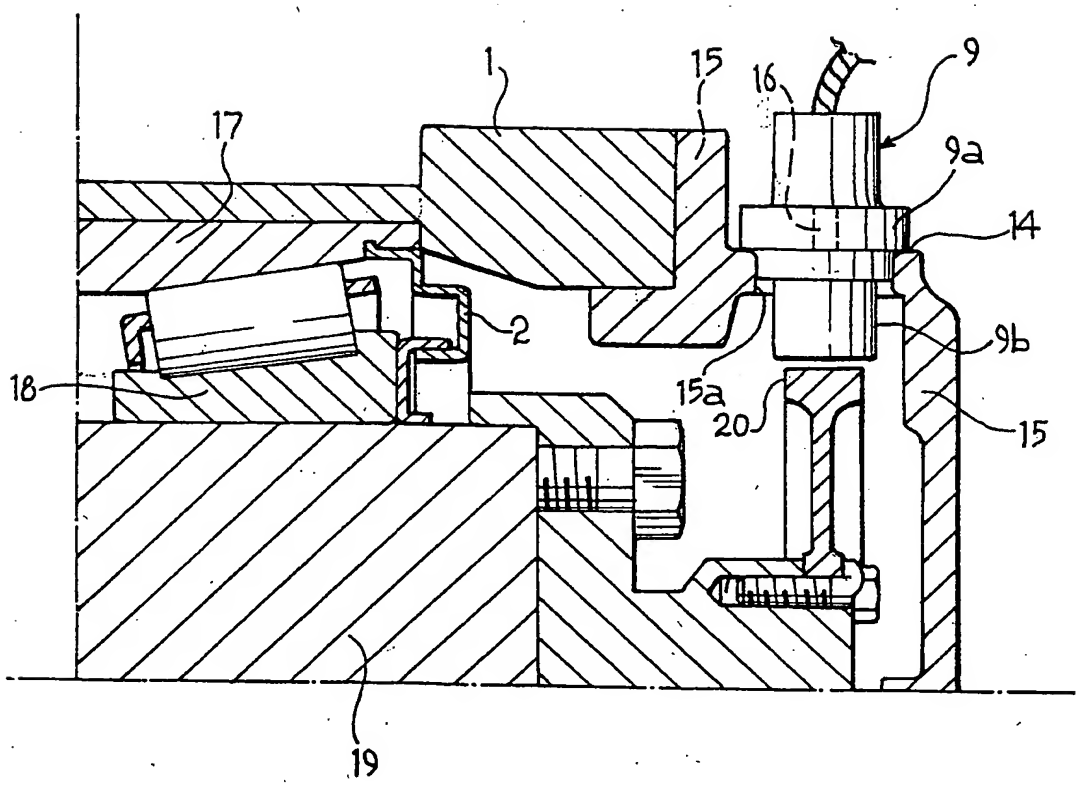


FIG. 6



INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/EP 00/01690

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B61K9/12 B61K9/04 B61F15/20 G01M13/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B61K B61F G01M B60B B60T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 11356 A (TALAFOUS JOSEPH A ;TIMKEN CO (US); MELVIN JASON W (US); FRENCH MIC) 19 March 1998 (1998-03-19) page 3, line 14 -page 15, line 13; figures 1-8	1
Y	DE 197 30 212 A (SAB WABCO KP GMBH) 11 February 1999 (1999-02-11) the whole document	1
Y	WO 97 22095 A (SECURITY OPERATING SYSTEMS INC ;SMITH CHARLES C (US); BERNARD THOM) 19 June 1997 (1997-06-19) page 5, line 7 -page 8, line 27; figures 1-3	1

-/—

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 May 2000	06/06/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Chlosta, P

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INTERNATIONAL SEARCH REPORT

Int. ional Application No
PCT/EP 00/01690

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 173 865 A (COAL IND) 22 October 1986 (1986-10-22) the whole document	1
A	GB 1 514 792 A (NIPPON SEIKO KK) 21 June 1978 (1978-06-21) page 2, line 3 - line 62; figures 1-3	1
A	US 3 745 815 A (BENTONE P ET AL) 17 July 1973 (1973-07-17) the whole document	1

1

INTERNATIONAL SEARCH REPORT

information on patent family members

Inte . onal Application No
PCT/EP 00/01690

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9811356 A	19-03-1998	AU 4345997 A	02-04-1998
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		EP 0925456 A	30-06-1999
DE 19730212 A	11-02-1999	NONE	
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		FR 2111434 A	02-06-1972
		GB 1304818 A	31-01-1973

DETAILED DESCRIPTION

[Detailed explanation of a design]
[0001]
[Industrial Application] The bearing unit for rotational-speed detection concerning this design is used that an anti-lock brake system (ABS) or a traction control system (TCS) should be controlled in order to detect the rotational speed of this wheel while supporting the wheel of an automobile free [rotation] to a suspension system.
[0002]
[Description of the Prior Art] You have to support the wheel of an automobile free [rotation] to a suspension system. Moreover, in order to control an anti-lock brake system (ABS) or a traction control system (TCS), it is necessary to detect the rotational speed of the above-mentioned wheel. The bearing unit for rotational-speed detection of structure as shown in a U.S. Pat. No. 4938612 specification at drawing 7 is indicated from the former as a bearing unit for rotational-speed detection for it.
[0003] The bearing unit for rotational-speed detection shown in this drawing 7 is enabling support of the fixed ring 2 which has the outer-ring-of-spiral-wound-gasket orbits 1 and 1 of a double row in inner skin by the attachment section 3 formed in the periphery side at the suspension system. One pair of inner rings of spiral wound gasket 5 and 5 which have the above-mentioned outer-ring-of-spiral-wound-gasket orbits 1 and 1 and the inner-ring-of-spiral-wound-gasket orbits 4 and 4 which counter inside this fixed ring 2 in each periphery side are arranged. between the outer-ring-of-spiral-wound-gasket orbits 1 and 1 of the above-mentioned fixed ring 2, and the inner-ring-of-spiral-wound-gasket orbits 4 and 4 of inner rings of spiral wound gasket 5 and 5 Each forms two or more rolling elements 7 and 7 held by cages 6 and 6, and is supporting one pair of inner rings of spiral wound gasket 5 and 5 free [rotation] inside the above-mentioned fixed ring 2. The one above-mentioned pair of inner rings of spiral wound gasket 5 and 5 are attached outside the minor diameter section 9 formed in the edge of the rotation axle 8, and are carrying out pinching fixation of both the inner rings of spiral wound gasket 5 and 5 between the nut 10 screwed on the edge of this rotation axle 8, and the step 11 formed in the toe of the above-mentioned minor diameter

section 9.

[0004] Moreover, fitting fixation of the pulse rotor 12 which formed the whole in the shape of a tube is carried out in the edge periphery side [on the other hand / (left of drawing 7)] of an inner ring of spiral wound gasket 5 by bending a metal plate in the shape of a cross-section crank. On the other hand, this sensor 13 is made to counter the portion between the outer-ring-of-spiral-wound-gasket orbits 1 and 1 of the above-mentioned double row from a periphery side in support of a sensor 13 with a part of above-mentioned fixed ring 2 at the above-mentioned pulse rotor 12.

[0005] The bearing unit for rotational-speed detection constituted as mentioned above detects the rotational speed of the above-mentioned wheel while supporting the wheel supported by the rotation axle 8 free [rotation] to the suspension system which supported the fixed ring 2. That is, it changes on the frequency to which the output of the above-mentioned sensor 13 is proportional to the rotational speed of a wheel with rotation of a wheel. Therefore, if it inputs into the controller which does not illustrate the output signal of this sensor 13, based on the rotational speed which asked for the rotational speed of the above-mentioned wheel, and searched for Above ABS and TCS, it is appropriately controllable.

[0006]

[Problem(s) to be Solved by the Device] However, the trouble which is described below and which should be solved exists in the conventional bearing unit for rotational-speed detection which is constituted as mentioned above and acts. That is, since inner rings of spiral wound gasket 5 and 5 are only supported inside the fixed ring 2 through two or more rolling elements 7 and 7, respectively, before carrying out outside attachment support of the assembly work middle class and these inner rings of spiral wound gasket 5 and 5 during part transportation at the aforementioned minor diameter section 9, each inner rings of spiral wound gasket 5 and 5 tend to fall out from the inside of the fixed ring 2.

[0007] as technology for preventing that an inner ring of spiral wound gasket falls out from the inside of the outer-ring-of-spiral-wound-gasket equivalent member of fixed ring 2 grade, the structure with which the stop projected part formed in the inner circumference edge of a cage and the stop slot formed in the peripheral surface outside each inner ring of spiral wound gasket are made to engage is known as indicated by JP,2-78811,U, for example However, in the case of the bearing unit for rotational-speed detection set as the object of this design, the above-mentioned stop slot cannot be formed in the inner ring of spiral wound gasket 5 which carried out outside attachment support of the pulse rotor 12, and it cannot be adopted as it as it is. The bearing unit for rotational-speed detection of this design is considered that the above problems should be coped with.

[0008]

[Means for Solving the Problem] The fixed ring which has the outer-ring-of-spiral-wound-gasket orbit of a double row in inner skin like the conventional bearing unit for rotational-speed detection mentioned above as for the bearing unit for

rotational-speed detection of this design, One pair of inner rings of spiral wound gasket which have the above-mentioned outer-ring-of-spiral-wound-gasket orbit and the inner-ring-of-spiral-wound-gasket orbit which counters in each periphery side, With two or more rolling elements prepared between the outer-ring-of-spiral-wound-gasket orbit of the above-mentioned fixed ring. and the family inner-ring-of-spiral-wound-gasket orbit, respectively. the pulse rotor supported by one inner ring of spiral wound gasket of the one above-mentioned pair of inner rings of spiral wound gasket, and a part of above-mentioned fixed ring It is supported by the portion between the outer-ring-of-spiral-wound-gasket orbits of the above-mentioned double row, and constitutes from a sensor which counters the above-mentioned pulse rotor from a periphery side.

[0009] It constitutes from a main part of the shape of a basket form cylinder which covers a circumferencial direction by the product made from magnetic material in the above-mentioned pulse rotor, and has two or more bores in regular intervals in the bearing unit for rotational-speed detection of this design especially, and a stop member combined with non-**, to the above-mentioned main part by making the part engage with the above-mentioned bore by the product made from nonmagnetic material which has elasticity. and -- while carrying out outside attachment support of the shaft-orientations end approach portion of the above-mentioned main part at the edge of above-mentioned one inner ring of spiral wound gasket -- the above-mentioned stop -- the stop hook which protruded on the shaft-orientations other end inner skin of a member is made to engage with the stop concave formed in the edge periphery side of the inner ring of spiral wound gasket of another side

[0010]

[Function] Since one pair of inner rings of spiral wound gasket are mutually combined through a pulse rotor in the case of the bearing unit for rotational-speed detection of this design constituted as mentioned above, it can prevent that each inner ring of spiral wound gasket falls out from the inside of a fixed ring also before attachment. And linear dimension covering the shaft orientations of the main part of a pulse rotor and two or more bores formed in this main part can be made long related enough in the structure which combines one pair of inner rings of spiral wound gasket. Therefore, rotational-speed detection using this bore can be ensured.

[0011]

[Example] Drawing 1 -4 show the first example of this design. The fixed ring 2 which has the outer-ring-of-spiral-wound-gasket orbits 1 and 1 of a double row in inner skin makes support free by the attachment section 3 formed in the periphery side at the suspension system. Inside this fixed ring 2, one pair of inner rings of spiral wound gasket 5a and 5b which have the above-mentioned outer-ring-of-spiral-wound-gasket orbits 1 and 1 and the inner-ring-of-spiral-wound-gasket orbits 4 and 4 which counter in each periphery side are arranged. And one pair of inner rings of spiral wound gasket 5a and 5b are supported free [rotation] inside the above-mentioned fixed ring 2 by forming the rolling elements 7 and 7 of

every plurality held by cages 6 and 6, respectively between the outer-ring-of-spiral-wound-gasket orbits 1 and 1 of the above-mentioned fixed ring 2, and the inner-ring-of-spiral-wound-gasket orbits 4 and 4 of inner rings of spiral wound gasket 5a and 5b. The one above-mentioned pair of inner rings of spiral wound gasket 5a and 5b are attached outside the minor diameter section 9 formed in the edge of the rotation axle 8 in the state of attachment by vehicles. And pinching fixation of both the inner rings of spiral wound gasket 5a and 5b is carried out between the nut 10 screwed on the edge of this rotation axle 8, and the step 11 formed in the toe of the above-mentioned minor diameter section 9.

[0012] The other end approach portion (drawing 1 , 3 rightist-inclinations portions) is carrying out outside attachment pressing fixation of the shaft-orientations end approach portion (drawing 1 , 3 rightist-inclinations portions) of the pulse rotor 14 at the toe [on the other hand / (drawing 1 ; 3 lefts)] (drawing 1 , 3 right end sections) of inner-ring-of-spiral-wound-gasket 5a in the state of projecting from the inner edge (drawing 1 , 3 right end edges) of the above-mentioned inner-ring-of-spiral-wound-gasket 5a, among the one above-mentioned pair of inner rings of spiral wound gasket 5a and 5b. the above-mentioned pulse rotor 14 -- the main part 15 made from magnetic material, such as a mild steel board, and the stop made from nonmagnetic material -- it constitutes by combining a member 16 The main part 15 of these is made into the shape of a basket form cylinder by covering a circumferencial direction and forming two or more bores 17 and 17 in regular intervals. In addition, in the case of the example of illustration, each bores 17 and 17 are brought near and formed in the other end (drawing 1 , 3 right ends) side of a main part 15. This is for enlarging width of face of the rib by the side of the end fixed to inner-ring-of-spiral-wound-gasket 5a (drawing 1 , 3 left-hand side).

[0013] moreover, a stop -- by the nonmagnetic material which has elasticity, the member 16 forms rubber, synthetic resin, etc., as shown in drawing 4 this stop -- a member 16 consists of engagement **** 18 and 18 which shakes to the bores 17 and 17 of the above-mentioned main part 15, and fits in that there is nothing, and the annulus ring section 19 formed in the state of making the other end (drawing 1 , 3 or 4 right end sections) inner circumference edges of each engagement **** 18 and 18 continuing It is made to function as a cone concave surface to which a bore becomes large as a stop hook to which this annulus ring section 19 engages with the stop concave 20 mentioned later, so that the inner skin of this annulus ring section 19 goes to the other end of above-mentioned engagement **** 18 and 18.

[0014] the main part 15 constituted as mentioned above and a stop -- a member 16 -- a stop -- while carrying out elastic deformation of the annulus ring section 19 of a member 16 -- this stop -- engagement **** 18 and 18 of a member is pushed in inside a main part 15 and it is shown in drawing 1 -3 -- as -- the inside of the bore 17 of a main part 15, and 17 -- a stop -- it combines with the state where engagement **** 18 and 18 of a member 16 was made to fit in, and considers as the pulse rotor 14 this state -- the above-mentioned stop -- the annulus ring section 19 of a member 16 projects in the method of the inside of the diameter direction from

the end circles peripheral surface of the above-mentioned main part 15 thus, the above-mentioned main part 15 and a stop -- the pulse rotor 14 which consists of a member 16 is carrying out support fixation to this inner-ring-of-spiral-wound-gasket 5a by attaching the end section of a main part 15 outside the toe of aforementioned one inner-ring-of-spiral-wound-gasket 5a this state -- the other end of the above-mentioned pulse rotor 14 -- from the inner edge of inner-ring-of-spiral-wound-gasket 5a -- projecting -- this protrusion -- the bottom -- the above-mentioned stop from the inner skin of a portion -- the annulus ring section 19 of a member 16 -- a protrusion -- it will be in a state the bottom

[0015] On the other hand, among the one aforementioned pair of inner rings of spiral wound gasket 5a and 5b, a perimeter is covered and the stop concave 20 is formed in the edge periphery side of inner-ring-of-spiral-wound-gasket 5b of another side. It prevents that the above-mentioned annulus ring section 19 which is a stop hook is engaged in this stop concave 20, and inner-ring-of-spiral-wound-gasket 5b of above-mentioned another side separates from one inner-ring-of-spiral-wound-gasket 5a where the bearing unit for rotational-speed detection is assembled. Before attaching inner rings of spiral wound gasket 5a and 5b to the minor diameter section 9 grade of the rotation axle 8, even if it is for this reason, it prevents that each inner rings of spiral wound gasket 5a and 5b fall out from the inside of the fixed ring 2.

[0016] In addition, in the case of the example of illustration, as shown in drawing 1, eccentricity of the detecting element at sensor 13 nose of cam fixed to the fixed ring 2 is carried out to the axial center of sensor 13 main part. This is for making the above-mentioned detecting element counter the bores 17 and 17 of the pulse rotor 14 in the shaft-orientations center section. By the bearing unit for rotational-speed detection of this design incorporating above pulse rotors 14 and sensors 13, since [which was mentioned above] it is the same as that of the case of structure conventionally, the operation at the time of detecting the rotational speed of this wheel, while supporting a wheel free [rotation] to a suspension system omits the overlapping explanation.

[0017] Next, drawing 5 -6 show the second example of this design. the stop which the first above-mentioned example formed apart from the main part 15 -- having constituted so that it might be pushed in inside a main part 15, carrying out elastic deformation of the member 16 -- receiving -- the case of this example -- a stop -- setting the above-mentioned main part 15 in a form block, in case injection molding of the member 16 is carried out -- the inside of this main part 15 -- a stop -- it is made to carry out mould fabrication of the member 16 Other composition and operations are the same as that of the case of the first example mentioned above.

[0018]

[Effect of the Device] Although the bearing unit for rotational-speed detection of this design is constituted as it was described above, and it acts, before attachment, it can prevent that an inner ring of spiral wound gasket falls out from the inside of a fixed ring, and can prevent loss

of parts, and complicated-ization of assembly operation. Moreover, fully secure the linear dimension covering the shaft orientations of a bore required for rotational-speed detection. this bore and the detecting element of a sensor are made to counter certainly, and reliable rotational-speed detection can be performed.

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)実用新案登録公報（Ｙ２）　(11)実用新案登録番号

第2539382号

(45)発行日　平成９年(1997)６月25日　　(24)登録日　平成９年(1997)４月11日

(51)Int.Cl.[6]	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｆ１６Ｃ　19/52			Ｆ１６Ｃ　19/52	
19/00			19/00	
41/00			41/00	
Ｇ０１Ｐ　3/487			Ｇ０１Ｐ　3/487	Ｆ

請求項の数１(全 5 頁)

(21)出願番号　実願平3－29364

(22)出願日　平成３年(1991)４月３日

(65)公開番号　実開平4－117920

(43)公開日　平成４年(1992)10月22日

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(56)参考文献　実開　平３－121214（ＪＰ，Ｕ）

(54)【考案の名称】　回転速度検出用軸受ユニット

(57)【実用新案登録請求の範囲】

【請求項１】　内周面に複列の外輪軌道を有する固定輪と、それぞれの外周面に上記外輪軌道と対向する内輪軌道を有する１対の内輪と、それぞれ上記固定輪の外輪軌道と内輪の内輪軌道との間に設けられた複数の転動体と、上記１対の内輪の内の一方の内輪に支持されたパルスロータと、上記固定輪の一部で、上記複列の外輪軌道の間部分に支持されて、上記パルスロータに外周側から対向するセンサとから成る回転速度検出用軸受ユニットに於いて、上記パルスロータを、磁性材製で円周方向に亙って等間隔に複数の透孔を有する竜形円筒状の本体と、弾性を有する非磁性材製でその一部を上記透孔に係合させる事により上記本体に対して不離に結合した係止部材とで構成し、上記本体の軸方向一端寄り部分を上記一方の内輪の端部に外嵌支持すると共に、上記係止部材の軸方向他端部内周面に突設した係止鉤部を、他方の内輪の端部外周面に形成した係止凹溝に係合させた事を特徴とする回転速度検出用軸受ユニット。

【考案の詳細な説明】

【０００１】

【産業上の利用分野】この考案に係る回転速度検出用軸受ユニットは、自動車の車輪を懸架装置に対して回転自在に支持すると共に、アンチロックブレーキシステム（ＡＢＳ）、或はトラクションコントロールシステム（ＴＣＳ）を制御すべく、この車輪の回転速度を検出する為に利用する。

【０００２】

【従来の技術】自動車の車輪は、懸架装置に対して回転自在に支持しなければならない。又、アンチロックブレーキシステム（ＡＢＳ）、或はトラクションコントロー

ルシステム（ＴＣＳ）を制御する為には、上記車輪の回転速度を検出する必要がある。この為の回転速度検出用軸受ユニットとして従来から、米国特許第４９３８６１２号明細書には、図７に示す様な構造の回転速度検出用軸受ユニットが開示されている。

【０００３】この図７に示した回転速度検出用軸受ユニットは、内周面に複列の外輪軌道１、１を有する固定輪２を、その外周面に形成した取付部３により、懸架装置に支持自在としている。この固定輪２の内側には、それぞれの外周面に上記外輪軌道１、１と対向する内輪軌道４、４を有する１対の内輪５、５を配置し、上記固定輪２の外輪軌道１、１と内輪５、５の内輪軌道４、４との間に、それぞれが保持器６、６により保持された複数の転動体７、７を設けて、上記固定輪２の内側に１対の内輪５、５を、回転自在に支持している。上記１対の内輪５、５は、回転車軸８の端部に形成した小径部９に外嵌し、この回転車軸８の端部に螺着したナット１０と上記小径部９の内端部に形成した段部１１との間で、両内輪５、５を挟持固定している。

【０００４】又、一方（図７の左方）の内輪５の端部外周面には、金属板を断面クランク状に折り曲げる事により全体を円管状に形成した、パルスロータ１２を嵌合固定している。一方、上記固定輪２の一部で、上記複列の外輪軌道１、１の間部分にはセンサ１３を支持して、このセンサ１３を上記パルスロータ１２に外周側から対向させている。

【０００５】上述の様に構成される回転速度検出用軸受ユニットは、回転車軸８に支持された車輪を、固定輪２を支持した懸架装置に対して回転自在に支持すると共に、上記車輪の回転速度を検出する。即ち、車輪の回転に伴なって上記センサ１３の出力が、車輪の回転速度に比例した周波数で変化する。従って、このセンサ１３の出力信号を図示しない制御器に入力すれば、上記車輪の回転速度を求め、前記ＡＢＳやＴＣＳを、求めた回転速度に基づいて適切に制御できる。

【０００６】

【考案が解決しようとする課題】ところが、上述の様に構成され作用する従来の回転速度検出用軸受ユニットに於いては、次に述べる様な解決すべき問題点が存在する。即ち、内輪５、５は、それぞれ複数の転動体７、７を介して、固定輪２の内側に支持されているだけである為、部品輸送中、或は組み立て作業中等、この内輪５、５を前記小径部９に外嵌支持する以前に於いては、各内輪５、５が固定輪２の内側から脱落し易い。

【０００７】固定輪２等の外輪相当部材の内側から内輪が脱落するのを防止する為の技術としては、例えば実開平２－７８８１１号公報に開示されている様に、保持器の内周縁に形成した係止突部と各内輪の外周面に形成した係止溝とを係合させる構造が知られている。ところが、本考案の対象となる回転速度検出用軸受ユニットの場合、パルスロータ１２を外嵌支持した内輪５に上記係止溝を形成する事ができず、そのまま採用する事はできない。本考案の回転速度検出用軸受ユニットは、上述の様な問題に対処すべく考えたものである。

【０００８】

【課題を解決する為の手段】本考案の回転速度検出用軸受ユニットは、前述した従来の回転速度検出用軸受ユニットと同様に、内周面に複列の外輪軌道を有する固定輪と、それぞれの外周面に上記外輪軌道と対向する内輪軌道を有する１対の内輪と、それぞれ上記固定輪の外輪軌道と内輪の内輪軌道との間に設けられた複数の転動体と、上記１対の内輪の内の一方の内輪に支持されたパルスロータと、上記固定輪の一部で、上記複列の外輪軌道の間部分に支持されて、上記パルスロータに外周側から対向するセンサとから構成する。

【０００９】特に、本考案の回転速度検出用軸受ユニットに於いては、上記パルスロータを、磁性材製で円周方向に亙って等間隔に複数の透孔を有する篭形円筒状の本体と、弾性を有する非磁性材製でその一部を上記透孔に係合させる事により上記本体に対して不離に結合した係止部材とで構成する。そして、上記本体の軸方向一端寄り部分を上記一方の内輪の端部に外嵌支持すると共に、上記係止部材の軸方向他端部内周面に突設した係止鉤部を、他方の内輪の端部外周面に形成した係止凹溝に係合させる。

【００１０】

【作用】上述の様に構成される本考案の回転速度検出用軸受ユニットの場合、１対の内輪を、パルスロータを介して互いに結合する為、組み付け前に於いても、各内輪が固定輪の内側から脱落する事を防止できる。しかも、パルスロータの本体、並びにこの本体に形成する複数の透孔の軸方向に亙る長さ寸法を、１対の内輪を結合する構造に関係なく十分に長くできる。従って、この透孔を利用しての回転速度検出を確実に行なえる。

【００１１】

【実施例】図１～４は本考案の第一実施例を示している。内周面に複列の外輪軌道１、１を有する固定輪２は、その外周面に形成した取付部３により、懸架装置に支持自在としている。この固定輪２の内側には、それぞれの外周面に上記外輪軌道１、１と対向する内輪軌道４、４を有する１対の内輪５ａ、５ｂを配置している。そして、上記固定輪２の外輪軌道１、１と内輪５ａ、５ｂの内輪軌道４、４との間に、それぞれ保持器６、６により保持された複数ずつの転動体７、７を設ける事により、上記固定輪２の内側に１対の内輪５ａ、５ｂを、回転自在に支持している。車両への組み付け状態で上記１対の内輪５ａ、５ｂは、回転車軸８の端部に形成した小径部９に外嵌する。そして、この回転車軸８の端部に螺着したナット１０と、上記小径部９の内端部に形成した段部１１との間で、両内輪５ａ、５ｂを挟持固定する。

【００１２】上記１対の内輪５ａ、５ｂの内、一方（図１、３の左方）の内輪５ａの内端部（図１、３の右端部）には、パルスロータ１４の軸方向一端寄り部分（図１、３の右寄り部分）を、その他端寄り部分（図１、３の右寄り部分）が上記内輪５ａの内端縁（図１、３の右端縁）から突出する状態で、外嵌圧入固定している。上記パルスロータ１４は、軟鋼板等の磁性材製の本体１５と、非磁性材製の係止部材１６とを組み合わせる事により構成している。この内の本体１５は、円周方向に亙って等間隔に複数の透孔１７、１７を形成する事により、篦形円筒状としている。尚、図示の実施例の場合、各透孔１７、１７を、本体１５の他端（図１、３の右端）側に寄せて形成している。これは、内輪５ａに対して固定する一端側（図１、３の左側）のリブの幅を大きくする為である。

【００１３】又、係止部材１６は、ゴム、合成樹脂等、弾性を有する非磁性材により、図４に示す様に形成している。この係止部材１６は、上記本体１５の透孔１７、１７にがたつきなく嵌合する係合杆部１８、１８と、各係合杆部１８、１８の他端部（図１、３、４の右端部）内周縁同士を連続させる状態で形成した円環部１９とから成る。この円環部１９の内周面は、上記係合杆部１８、１８の他端に向かう程内径が大きくなる円錐凹面として、この円環部１９が、後述する係止凹溝２０と係合する、係止鉤部として機能する様にしている。

【００１４】上述の様に構成される本体１５と係止部材１６とは、係止部材１６の円環部１９を弾性変形させつつ、この係止部材の係合管部１８、１８を本体１５の内側に押し込む。そして、図１～３に示す様に、本体１５の透孔１７、１７内に係止部材１６の係合杆部１８、１８を嵌合させた状態に組み合わせ、パルスロータ１４とする。この状態で上記係止部材１６の円環部１９は、上記本体１５の一端部内周面から直径方向内方に突出する。この様に上記本体１５と係止部材１６とから成るパルスロータ１４は、本体１５の一端部を前記一方の内輪５ａの内端部に外嵌する事により、この内輪５ａに対し支持固定している。この状態で、上記パルスロータ１４の他端部は、内輪５ａの内端縁から突出し、この突出した部分の内周面から上記係止部材１６の円環部１９が突出した状態となる。

【００１５】一方、前記１対の内輪５ａ、５ｂの内、他方の内輪５ｂの端部外周面には係止凹溝２０を、全周に亙って形成している。回転速度検出用軸受ユニットを組み立てた状態でこの係止凹溝２０内には、係止鉤部である、上記円環部１９が係合し、上記他方の内輪５ｂが一方の内輪５ａから離れるのを阻止する。この為、内輪５ａ、５ｂを回転車軸８の小径部９等に組み付ける以前であっても、各内輪５ａ、５ｂが固定輪２の内側から脱落する事を防止する。

【００１６】尚、図示の実施例の場合、固定輪２に固定したセンサ１３先端の検出部は、図１に示す様に、センサ１３本体の軸心に対し偏心させている。これは、上記検出部をパルスロータ１４の透孔１７、１７に、軸方向中央部で対向させる為である。上述の様なパルスロータ１４とセンサ１３とを組み込んだ本考案の回転速度検出用軸受ユニットにより、車輪を懸架装置に対して回転自在に支持すると共に、この車輪の回転速度を検出する際の作用は、前述した従来構造の場合と同様である為、重複する説明を省略する。

【００１７】次に、図５～６は本考案の第二実施例を示している。前述の第一実施例が、本体１５と別に形成した係止部材１６を、弾性変形させつつ本体１５の内側に押し込む様に構成していたのに対して、本実施例の場合には、係止部材１６を射出成形する際、成形型内に上記本体１５をセットしておく事により、この本体１５の内側に係止部材１６を、モールド成形する様にしている。その他の構成及び作用は、前述した第一実施例の場合と同様である。

【００１８】

【考案の効果】本考案の回転速度検出用軸受ユニットは、以上に述べた通り構成され作用するが、組み付け前に固定輪の内側から内輪が脱落するのを防止できて、部品の紛失や組立作業の繁雑化を防止できる。又、回転速度検出の為に必要な透孔の軸方向に亙る長さ寸法を十分に確保して、この透孔とセンサの検出部とを確実に対向させて、信頼性の高い回転速度検出を行なえる。

【図面の簡単な説明】

【図１】本考案の第一実施例を示す断面図。

【図２】図１のＡ－Ａ断面図。

【図３】図１から要部のみを取り出して示す拡大断面図。

【図４】パルスロータを構成する係止部材の斜視図。

【図５】本考案の第二実施例を示す、図３と同様の断面図。

【図６】パルスロータの拡大断面図。

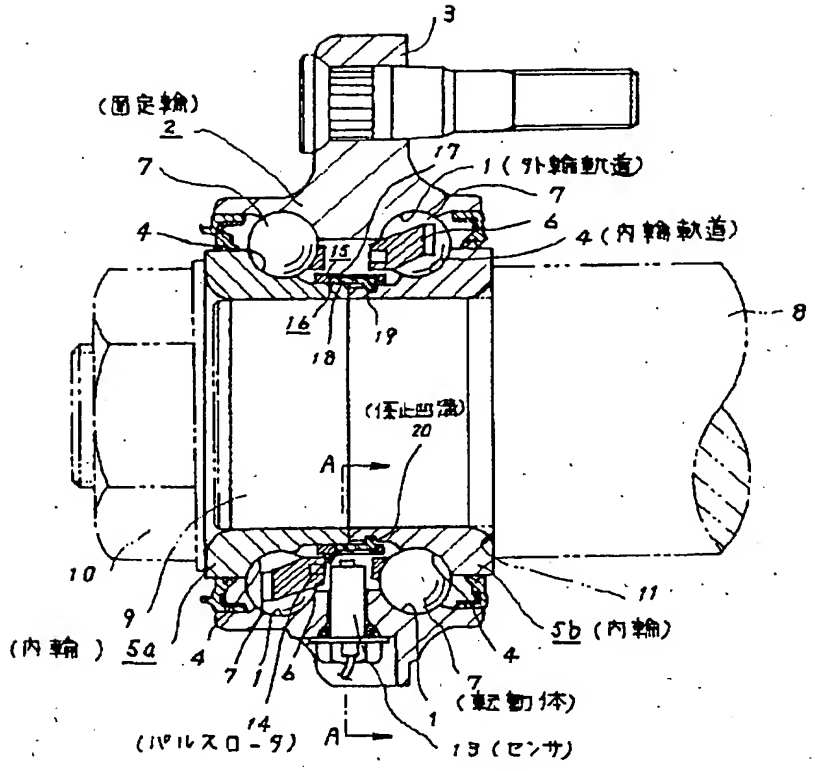
【図７】従来構造の１例を示す断面図。

【符号の説明】

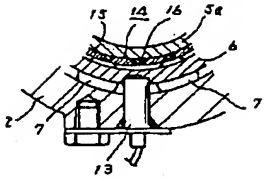
１　外輪軌道
２　固定輪
３　取付部
４　内輪軌道
５　内輪
５ａ　内輪
５ｂ　内輪
６　保持器
７　転動体
８　回転車軸
９　小径部
１０　ナット
１１　段部

１２　パルスロータ
１３　センサ
１４　パルスロータ
１５　本体
１６　係止部材
１７　透孔
１８　係合杆部
１９　円環部
２０　係止凹溝

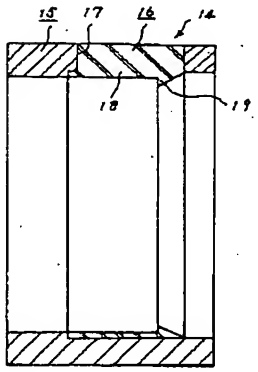
【図１】



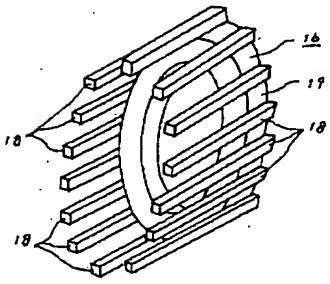
【図２】



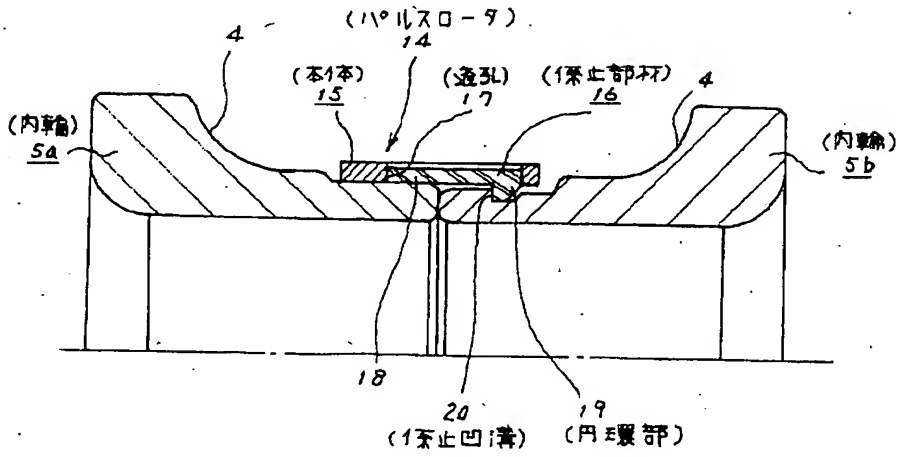
【図６】



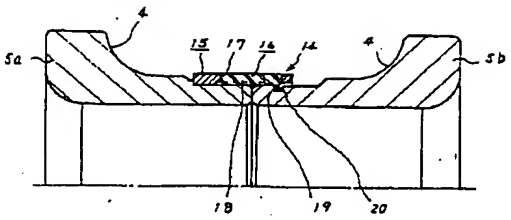
【図４】



【図３】



【図５】



【図７】